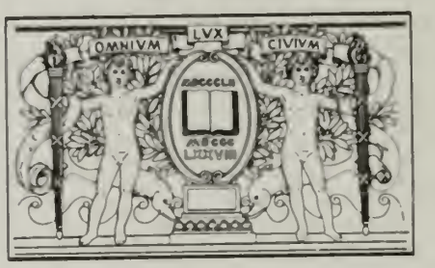
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THE BOSTON REGION

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THE BOSTON REGIONAL SURVEY

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April 1963

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The Commonwealth of Massachusetts
Mass Transportation Commission
120 Tremont Street, Boston 33

DR. JOSEPH F. MALONEY
EXECUTIVE DIRECTOR

April, 1963

Mr. Charles J. Horan
Regional Director of Urban Renewal
Housing and Home Finance Agency
346 Broadway
New York 13, New York

Dear Mr. Horan:

The following is the final summary report of the Mass Transportation Commission for the Boston Regional Survey (Mass. P-24). This report has been prepared as a non-technical overview for wide dissemination to the public, community leaders and agency personnel throughout the Boston region.

As stated in the MTC contract with HHFA, the study was designed to:

1. Assemble information on all major plans and proposals for land use, transportation and related matters.

2. Summarize this material in compact form.

3. Analyze the implications of proposed transportation and land use developments.

4. Identify and recommend priority areas where coordination is urgently needed.

5. Recommend items for further research with respect to preparation of comprehensive regional development plans.

This report accomplishes the first three of these five objectives. Assisted by research materials developed in the course of the study, the

latter two have been implemented by the Mass. P-34 project under which your office has made a $1.6 million Urban Planning Assistance Grant to the MTC to be supplemented by $800,000 of Commission funds. The planning project is being undertaken with the cooperation of the State Department of Public Works and the Federal Bureau of Public Roads with the use of $2.4 million of 1 1/2% highway research funds. This comprehensive regional development project is unprecedented in magnitude and in degree of intensive inter-agency cooperation.

The Boston Regional Survey has been of substantial assistance to the MTC in the formulation of its $5.4 million Mass Transportation Demonstration Experiment Program. This Demonstration Program, which involves a series of highly successful experiments with commuter railroads, bus companies and the Metropolitan Transit Authority, is now nearly completed with the aid of a $3.6 million HHFA Mass Transportation Demonstration Grant and $1.8 million in MTC funds.

While we owe a debt of gratitude to the public agencies in the region for their cooperation in providing materials for this study and in reviewing its contents, we wish to make clear that none of these agencies is responsible for the analytical contents of the report. The individual chapters do not necessarily reflect the views of these agencies. For example, the chapter "Highways" is not necessarily the official interpretation of the Department of Public Works, the Massachusetts Turnpike Authority or the Metropolitan District Commission. The chapter "Public Transportation" does not necessarily reflect the views of the commuter railroads or the Metropolitan Transit Authority, nor does the chapter "Ports and Airports" necessarily represent the official position of the Massachusetts Port Authority.

We wish to express our deep appreciation and gratitude to HHFA staff in the New York and Washington offices for their assistance and understanding in completing this study and to the many public and private agencies, public officials and private citizens who have contributed significantly to its contents.

Very truly yours,

Joseph F. Maloney

Joseph F. Maloney
Executive Director

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THE BOSTON REGION

The theory that the states of the union should function as political and social laboratories, originating and testing programs which may prove valid on a broad scale, has remained an academic dream rather than a practical reality during the past decade. A major reason for this failure is financial stringency: with few exceptions the states have found it extremely difficult to meet their present commitments, let alone secure additional monies for new ventures.

However, the advent of large scale federal matching programs in the fields of planning and transportation has provided a new opportunity for states to resume their experimental role. One example of a pioneering effort, which would have been impossible to conduct without federal assistance, is the Commonwealth of Massachusetts' Mass Transportation Commission Boston Regional Survey and the $10.2 million integrated planning and demonstration program.

The Housing Act of 1961 and the Bureau of Public Roads 1½% highway research funds are the source of federal aid for regional planning and mass transportation demonstration experiments. Within the framework of both the Housing Act and the highway research fund there is ample room to formulate programs uniquely adapted to local circumstances yet capable of making a substantial contribution to planning in all urban areas. The precise nature of the governmental machinery utilized in any given area to undertake regional planning and demonstration programs is not precisely detailed by the HHFA and BPR. The requirements are simple: the agency applying for funds must be officially empowered to operate effectively. It must offer a well planned, productive program and must provide assurance of yielding work of the highest professional standards. In short, proof must be furnished that federal funds will be wisely and prudently spent.

In both form and substance the creation and operations of the Mass Transportation Commission is Massachusetts' unique response to the intricate problems of regional development and transportation. The agency has an unusual structure; it is a combination of an inter-agency organization through the ex-officio membership of the heads of six major state transportation agencies, and a public agency through its five citizen members. It is also unique in substantive functions: the MTC not only acts as both a formal and informal consultative body and problem resolving center for its member agencies but it also serves as a technical advisor to the state legislature and to the executive department of the state government.

The MTC has been assisted in its operations by its close linkages to transportation agencies as well as its role as advisor to the executive department and the legislature on intricate transportation problems. MTC's ability to tap major reservoirs of federal funds is also significant. In state government as in many universities and private industries, an ability to sell federal agencies on the merits of a particular program has become increasingly significant. In addition, increasingly urgent transportation problems, particularly the prospect of abandonment of commuter rail service, and the MTA deficit and extension problem led both to the formation of the MTC and to its growing importance in the constellation of state agencies. Finally, the increasing federal insistence on comprehensive regional planning as prerequisite to federal highway and mass transportation grants has caused many decision makers to appreciate that the MTC program was necessary as a prerequisite to receiving future federal grants.

Priority Areas for Research

The survey has revealed that many of the major problems of the region stem from the need to adjust to two trends. The first is suburbanization and decentralization. Although population and economic growth is proceeding at a slower pace in the region than in many urban areas of the nation, nevertheless between 1960 and 1980 a population expansion of almost 700,000 — equal to the present population of the city of Boston — is likely to occur in the region's suburbs. In addition, most of the region's economic growth, (as well as its new automobile registrations) is also likely to be located in suburban areas. Meanwhile major changes will be taking place in the population and economic structures and in the functions of the central cities. Fundamental changes of this magnitude will create stresses and problems in the field of transportation, land use, and municipal finance. Unless effective methods can be found to deal with these problems, they will approach crisis proportions long before 1980.

The second major trend in the Boston region is closely linked to its moderate growth. This is the persistence of the traditional, a dominant densely built-up core area, and a form of governmental and political organization and procedure which tends to diffuse decision making power.

A number of the regions most critical problems arise from the fact that many of these traditional patterns are unsuited to modern needs. Massive efforts are needed in the core area to prevent it from becoming an antiquated slum, and basic adjustments are required in Massachusetts out-moded government organization.

The MTC's Boston Regional Survey indicated that:

(1) transportation activities in the region have been operating in an uncoordinated fashion;

(2) land use, population and economic needs have not been adequately considered in transportation planning;

(3) the consequences of alternate courses of action have not been measured to guide state and local agencies in major decisions;

(4) some localities believe that the present transportation decision-making process gives too little consideration to community desires and needs;

(5) a number of ambitious development plans in the region have failed of implementation;

(6) brush-clearing to dispel some of the persistent myths about transportation and regional development as a precondition to formulation of effective realistic action programs;

(7) there is inadequate information available to the decision makers and to the public to provide a basis for allocating funds for major capital investments in transportation facilities. A good deal of basic research is needed in the fields of population, land use, and economic base to provide guide lines for decisions at the state and local level. Such research materials as are now available on population, land use, economic base and transportation are not sufficiently definitive to serve as the basis for plans involving major decisions and large scale capital investments.

Two major transportation decisions confront the region:

(1) With the prospect of early termination of all commuter service the region will be faced with the alternatives of marshalling additional public support for commuter lines or permitting outright abandonment. Realistic information on railroad revenues and costs (including the effects of fare reductions and service increases) and on the cost and benefits of available alternatives is necessary before a prudent policy can be formulated.

(2) Decisions must be made about the future of the Metropolitan Transit Authority. The principal decision will involve one or more possible extensions of rapid transit to suburban areas, either by means of expansion of the MTA district or by establishment of special suburban transit districts. The *Coolidge Commission* reports of 1945 and 1947 and other later studies favoring extensions do not provide an adequate foundation upon which to base present decisions. These studies provide much useful information but their limitations in scope and method restrict their adequacy for formulating a system of priorities and guides for major policy decisions. Specifically, firm information is needed on market potentials, and on probable operating revenues and expenditures. In addition, comprehensive information is required on the alternative consequences for regional and local development of construction of a highway oriented transportation system versus a mixed transportation system with a strong mass transportation component.

In addition to the region's two urgent mass transportation problems, the survey identified other areas deserving research priority.

(1) It was found that an updating of highway plans was needed within a total transportation framework. In particular, a large scale origin and destination study is necessary to replace the 1945 information developed for the 1948 Master Highway Plan, which is still the basis for current highway planning. Moreover, a comprehensive transportation plan embracing major arterial streets and public transportation is badly needed. The new highway plan should be formulated as part of a master transportation plan. Highway plans must be closely related to land use, population and economic patterns and trends and careful attention to the local impact of alternative transportation and development patterns is necessary to develop a realistic and acceptable highway plan.

(2) Two of the key problems highlighted by the survey related to technology and its uses. Because advances in technological methods may alter the basic pattern of urban transportation, analysis of changing technology is vital in regional planning. In addition, basic information concerning transportation choices is needed. A fundamental, unanswered question in regional planning involves future mass transit ridership levels. Specifically, it is necessary to know under what fare, service and convenience conditions more people would use mass transit facilities. An analysis which would identify factors governing transit patronage levels will be valuable to transportation planning.

(3) A comprehensive analysis of the costs and benefits of different courses of action is needed to guide decisions on (a) the future of commuter railroads, (b) on constructing specific rapid transit extensions, (c) permitting current, unfavorable trends affecting mass transit to continue, (d) delaying construction of the Inner Belt and other core area expressway linkages, (e) of stimulating higher density suburban development, and (f) of a compact versus dispersed regional development pattern. The range of consequences for the state and federal government for the region and for communities and private citizens should be explored to provide a yardstick for basic development decisions.

(4) The wide gap between plans and performance offers significant lessons for future planning. The most serious deficiency has been in past and present proposals for rapid transit extensions which have for the most part been ignored. Furthermore although plans for expressway construction have generally met with more success, in recent years highway construction in densely built up core areas has run into a stone wall of opposition from property owners in the path of proposed expressway routes and their elected representatives in local and state government. Opposition has also blocked proposals for changes in railroad ownership

and management structure, for reconstitution of the MTA administrative and control structure, for establishment of a metropolitan planning agency and countless other recommendations. These experiences suggest that effectuation has been the weak link between plans and decision making. The survey indicated that careful attention to political, social and economic realities and particularly closer liaison with the power structure is a necessary prerequisite for effectuation.

The problem of effectuation of regional plans may be especially difficult in Massachusetts because of the fragmentation of power characteristic of the Commonwealth. Experience suggests that major inputs of effort and political acumen will be needed to fashion plans which combine technical acceptability and broad political consensus.

New Dimensions in Regional Transportation Planning

Aside from the basic building blocks of population, land use, the economic base and transportation studies which have traditionally provided the bulk of the subject matter of regional planning analysis, attention is beginning to focus on certain areas which have long been overlooked in regional research. The survey recognized the importance of certain of these neglected areas. Amenities — how development looks, how it functions and how this relates to passenger volumes — is one such area.

For the most part aesthetics has been mistakenly regarded as a monopoly of architects and preservationists. In recent years, however, prizes have begun to be awarded for attractive highways and appealing subdivisions and the time may not be far distant when transit systems are judged on the basis of their effect on the senses as well as their service and fare schedules.

As car ownership has become increasingly widespread, it has become feasible for most of the population to exercise a choice among various modes of transportation. One factor determining this choice is the relative unattractiveness of transit and commuter railroads as compared to private automobiles. This is true for the low-to-middle income groups in the MTA district which provide the bulk of present MTA riders. However, the element of choice is even stronger among the middle-to-high income groups who would provide a large proportion of the market for suburban transit. It is clear that a realistic evaluation of transportation patterns requires exploration of the psychological factors and value systems which are an important determinant of transportation choice.

Mass Transit v. the Automobile

The decline in mass transit patronage since the 1940's has led to considerable discussion as to the consequences of this trend and to speculation about the possibilities of reversing it. Rapid transit extensions and entire new systems involving major capital investment have been recommended in a number of metropolitan areas including Boston to link middle and upper income low density suburbs to the Central Business District.

Many of these planned systems are closer in design to modern buses and airplanes than to the bane functionalism of traditional subway cars and terminals. Thus, the vast gap in comfort and appearance between the automobile and the subway car may not be as much in evidence in future years. A considerable range of devices is now available to improve mass transit operations. Noise can be reduced to tolerable levels by the use of rubber-tired wheels; seating can be made more luxurious, lighting can be controlled and diffused; air freshening equipment is available; and terminal facilities can be greatly improved. Many of these features are included in systems which have been built or are in the planning stage in various parts of the nation. All of the proposed new systems come closer to the comfort standards of the private automobile than is the case with Boston's conventional rapid transit equipment and terminals.

However, it is recognized that to a degree the region's transit and highway systems overlap rather than duplicate; they serve different needs and markets and are judged on different criteria. Although precise knowledge of its market composition is lacking, many MTA riders are considered part of a "captive market" of riders too old, or too young, too infirm or too poor to operate automobiles. From the standpoint of this hard core market, aesthetics may be a secondary consideration. However, rising incomes free more of this market each year; the numbers of families too poor to afford automobiles is steadily diminishing, the future of mass transportation may depend on its ability to attract riders who can afford the automobile alternative.

Much of the planning underlying proposed new transit systems seems to assume that mass transportation must be and can be geared to capture a substantial part of the suburban market. In the Boston region, this implies a fundamental change in the unfavorable attitudes toward transit held by many suburban residents, particularly the middle and upper income families who seem to have deserted the transit market. Many people believe that the MTA is the working man's transportation.

However, past declines in transit patronage cannot wholly be laid at the door of middle class hostility toward the MTA. Ridership on commuter railroads, which provide quality transportation, has been declining faster than patronage on the MTA. This appears to indicate that relative status of public carriers is only part of the reason for reductions in ridership since the commuter rail lines are the traditional mode of transport of upper income executives.

Mass transit's poor appearance from an aesthetic standpoint has also been blamed for ridership declines. This seems to be an over-simplification. For example, the decline in commuter patronage is no more pronounced on the New Haven system which is served by

ill-kept conventional equipment than on the more modern service on the Boston and Maine Railroad's Budd cars. Moreover, as in the case elsewhere in the nation, the decrease in ridership levels on the MTA's relatively spartan rapid transit lines is far less substantial than the patronage decline on its modern buses.

Four basic reasons are advanced for the loss of riders on existing transit lines and conversely, for projecting large volumes of riders on proposed extensions:

(1) Transit ridership has declined in the past because transit systems have not been geared to provide efficient service to rapidly growing suburban areas.

(2) The form of metropolitan development will continue to be radial, with transportation corridors fanning out from a densely settled core area surrounding a major concentration of employment and other traffic generating activity. Since there is a reciprocal relationship between transit extension and intensive urban development most proponents of this viewpoint are strongly in favor of transit extensions to stimulate high density core and suburban development, continue urban compactness and safeguard the future of the downtown and core areas.

(3) From a functional standpoint, most journeys-to-work and shopping trips to the downtown area cannot be reasonably performed by automobile because of its neverending demands for limited expensive supplies of land, the high cost of building expressways through congested neighborhoods and the physical impossibility of providing parking space in downtown areas. Furthermore, mounting community opposition to the disruption of neighborhoods and parishes created by six to eight lane expressways, indicates that highway construction in densely developed core areas may be reaching its practical limits.

(4) Provided high quality transit service can be developed which serves both core and suburban areas, its convenience will be such that revenues derived from core and middle income suburban residents will ensure its financial viability. (A less widely held subsidiary view is that subsidization is socially and economically justified, and is required to keep transit operating at high volume.)

Many opponents of transit extension and construction maintain that the dispersed, low density suburban development pattern of recent decades will continue in the foreseeable future and that low densities require more highways rather than improved and expanded transit. Proceeding from this assumption, they believe that future transportation problems may primarily be concerned with moving population between low density suburbs to scattered work places and shopping centers. Regardless of any possible improvements in transit aesthetics and status, the automobile, they suggest, is the only vehicle capable of providing the flexibility and convenience to assemble widely dispersed labor forces and retail shoppers and link them with suburban plants and shopping centers.

The course of action implicit in the conclusions reached by this school of thought lead to self-fulfilling prophecies. In the belief that the tide is irrevocably running out on downtown and the core, proponents of this view believe that transportation expenditures should be allocated to expressways rather than mass transit systems. Inevitably a transportation program of this type would strengthen the suburbs and weaken the core which depends heavily on radial mass transit lines. In any event, their prognosis for mass transit is gloomy: no matter how appealing to the eye, they feel mass transportation is based on a declining pattern of concentrated urban development and cannot retain its importance in the future.

Some who believe in the economic future of the downtown area are in partial agreement with this automobile-centered viewpoint. Downtown merchants have objected to limitations on parking and traffic, strongly supported expanded expressway service and low fee parking garages in downtown areas and have frequently given only luke-warm support of transit systems. This pattern reflects their belief that the automobile rather than mass transit holds the key to the future of older downown areas, and that (except for rush hour service) the CBD's can successfully adapt to an automobile orientation.

Conflict and Consensus in Transportation Planning

It is useful to summarize some of the major elements of political consensus and conflict which have been analyzed in the survey and were taken into account in formulating the $10.2 million Boston regional planning study and the program of demonstration experiments. To begin with, a brief indication of the areas of consensus is useful, since agreement provides far less color and media copy than even minor conflicts.

(1) There is a strong tradition of increasing public control in the entire transportation field; the line between public and private responsibility is less rigid than it is in other aspects of the economy primarily because of the public utility aspects of transportation service. In consequence, a sizeable increase in federal aid, such as the 90-10 Interstate Highway Program or in public ownership as in the case of the MTA, meets with considerably less resistance than government activities in such areas as electric light and power generation and distribution. The tradition of private abandonment in favor of public ownership of deficit transportation operations has a long history in this region as well as in other parts of the nation. Furthermore, federal financial aid for depressed states and local areas meets with widespread acceptance in the region; political disputes often hinge on the relative ability of candidates to secure government assistance. This implies that it is possible to achieve ready acceptance of solutions to transportation problems based on major federal contributions to mass transportation.

(2) Control over land use by a combination of property owners, developers, local government authority and market factors is likely to remain a primary factor in changes affecting land use, subdivision and zoning in the region. Given the Massachusetts strong tradition of local autonomy, direct cession of land use controls to higher levels of government is improbable.

For this reason, the location, construction and timing of major capital improvements is the main avenue open to higher levels of government in shaping the regional land use pattern.

The principal instrument in state and regional influence on regional development lies in the field of transportation since the major questions of expressway location and timing have been resolved by the 1948 highway master plan and the toll road extension into Boston. This leaves two lines of action open: (1) the timing of the construction of the Inner Belt and its expressway linkages in the core and (2) efforts in the field of mass transportation. In a real sense both these actions are core-oriented. They would greatly strengthen the transportation network of the established central areas of the region by equalizing some of the relative advantages of access enjoyed by many suburban areas. However, efforts to complete the core area expressway system and to extend mass transportation may be theoretically acceptable to broad segments of the electorate and the leadership of the state and region (particularly if federal financial assistance or policy intervention becomes a more significant factor influencing these decisions), the precising of specific programs raises a number of actual and potential conflicts.

Conflicts and Solutions

A number of decisions relating to the major transportation issues confronting the region and to the alternate systems of values and interests have either erupted into conflict or loom in the background as future sources of disharmony. Many political explosions can be traced to fundamental divergences in outlook and interests which find expression in strong differences of opinion regarding particular transportation routes. As was indicated, two significant issues are the Inner Belt (and its connections) and transit extensions. The controversy which has raged around them illustrates some of the conflicts surrounding these basic transportation elements.

1. The Inner Belt and its radial expressway linkages were developed in the 1948 Master Highway Plan and for the most part the concept underlying this knitting together of the highway system at the region's core has had a favorable reception. A few opponents maintain that the whole job of providing core transportation might be more efficiently and more cheaply performed by an expanded mass transportation system. Others (mainly residents of other parts of the state), believe that the Boston area would receive a disproportionate share of state highway funds for its costly in-town expressways. However, aided by the fact that 90% of the funds for the Inner Belt and half the cost of other expressway construction was to come from federal sources early completion of the Inner Belt seemed likely.

The situation changed radically in 1960 with passage of a bill empowering the four communities in the path of the highway to veto route locations which they found unacceptable. Partly as a result of strong neighborhood opposition, Cambridge and Somerville protested immediately that the Inner Belt would require taking too many dwellings and would create serious loss of tax base. In 1962 the towns of Brookline also registered its objections to parts of the proposed route and soon afterward Boston's Mayor John F. Collins withdrew support from the proposed line of the road. Thus, while the concept of the Inner Belt and its linkages has won wide support from highway engineers, planners, the press and apparently most of the public, the veto power legislation permitted has brought construction of the Inner Belt and related highways to a halt.

The community veto represents an extension of the fragmentation of the Massachusetts governmental organization which is effective in blocking action but demands a difficult-to-achieve consensus in adopting and implementing action. In effect, the veto power permits property owners threatened with dislocation and neighborhoods and parishes confronted with disruption to register a powerful dissent to proposed highway routes through their local representatives. Moreover, the paralysis seems to be spreading; key linkages (such as the Southwest Expressway) are also being stalled by neighborhood opposition since in 1962 additional communities were given the power to block construction of highway routes by action of the legislature.

The net product of the community veto is to raise questions about the possibility of carrying forward any new projects in the Boston core area which involve significant amounts of land takings. For example, in the case of the city of Cambridge, in 1962 concern over the impasse resulting from neighborhood opposition to the Donnelly Field project led to federal withdrawal of financial support for that city's two major renewal projects, Houghton and Cambridgeport. Community opposition has also been one reason for the past failure to construct rapid transit extensions in the region.

At this time it is not possible to forecast whether through federal pressure and/or some compromise, methods can be found to complete the highway network called for in the 1948 Master Plan. It is apparent however that the Massachusetts' tradition of retaining and strengthening fragmentation of its decision making power has blocked completion of the core highway network, may seriously jeopardize the possibility of extending rapid transit lines and has terminated renewal projects. The lesson from this experience is that in the Boston region it may be extremely difficult to find ways of developing meaningful and acceptable solutions to regional planning problems which do not arouse a storm of local protests.

Transit Extensions

The possible extension of transit service to suburban areas is probably the single, strongest, unutilized method available to the state in shaping regional development patterns. For many reasons, transit extension is an issue fraught with the most complexities and a series of unresolved questions concerning the viability of new transit lines as was indicated in the Coolidge Commission study and other reports has assumed that patronage on proposed extensions would be extremely high, that the extensions not only would help to wipe out the MTA deficit but would make the system profitable. However, some maintain either that more proof is needed concerning the patronage, costs and financial returns of extensions or more pessimistically, allege that any prospect of achieving fiscal stability is illusory considering the persistent downward trend in MTA, commuter railroad and bus company ridership.

Over and above the arguments concerning the technical merits of transit extension and the size of the potential transit market, a good deal of the dispute over transit extensions can also be traced to conflicts in value systems and differential political and financial interest.

The Deficit Problem

Since member communities of the MTA District must assume the burden of making up the difference between MTA revenues and costs, suburban communities have been hesitant about permitting extensions which would bring them into the deficit zone; the only extensions constructed in recent years have been entirely within the District.

These suburban communities disputed the view that the proposed extension would pay their own way, much less turn the financial tide in the system as a whole.

In the belief that membership in the District inevitably results in higher real estate taxes, suburban areas have consistently opposed MTA extensions regardless of arguments about the potential contribution of extensions to the MTA system, to sales volume in the Boston Central Business District or to their assistance in relieving highway congestion. Also, some suburban merchant opposition to transit extensions has been created by the fear that easy access to downtown Boston would diminish the size of local "captive" markets. Considerable opposition also arises from the mistrust of MTA management. As an alternative, southern and western suburbs have explored the possibility of running financially independent districts physically but not administratively linked to the MTA. A South Shore Transit District and a stand-by transit district for the western suburbs have both been approved by legislature. However, there has been no actual initiation of transit operations via the standby-route.

The prospects of extending transit service may be substantially improved if large scale federal aid can be made available for this purpose. One possible source of funds was suggested in the North Terminal Area Study which suggested that $14 million in HHFA funds might be contributed to Boston's Charlestown renewal area for the removal of the existing elevated structure and the construction of a new elevated line as the first leg of an extension to suburban Reading.

Interests in favor of this extension include the Boston Redevelopment Authority which would secure substantial aid for its Charlestown area projects, the MTA which hopes to increase patronage and improve its financial position through suburban transit extension, and the Boston and Maine railroad which, if this plan were adopted, would be able to abandon one of its commuter passenger deficit routes while securing a substantial amount of cash from the sale of its right-of-way to Reading. Opponents of immediate extension to Reading do not fall into as readily identifiable categories, but most appear to be dubious of the financial feasability of the proposed line and or believe the Reading proposal to be premature in view of the MTC study and pending federal legislation, which may provide for substantial federal aid for mass transit construction programs. Proposed federal legislation to establish a $500 million fund to finance capital improvements for transit construction equipment failed to pass the 1962 session of Congress but it supposedly stands a better chance of being adopted in the 1963 session. If this bill becomes law, Massachusetts could conceivably secure as much as $62.5 million in two-thirds matching federal grants for transit construction and equipment. Although this federal aid will not solve the complex problem of operating deficits it might go a long way toward relieving the objections of opponents to transit extension and modernization.

Opposition from Interest Groups

Removal of immediate financial barriers to transit extension would not eliminate other sources of opposition. These include merchants in retail sub-centers who fear the loss of customers if low cost transit service were made available to downtown Boston; bus companies and other businessmen associated with the motor vehicle industry who would be adversely affected by a shift in ridership patterns; and local property owners and developers who charge that transit lines would blight adjacent property and weaken the market for large-lot housing. High density housing units have traditionally comprised a large proportion of new residential construction near transit lines and stations.

Distaste for the MTA, by no means confined to suburban areas, is another barrier to enlargement of the region's transit system. Experience elsewhere in the nation, particularly in the abortive effort to secure state financial aid for the Chicago Transit Authority, indicates that widespread dislike for transit agencies can be a powerful influence on the political decisions governing its future.

There is also a deeper conflict between suburban aspirations as opposed to central city patterns. Many observers of the postwar suburban migration believe that the former residents of central cities have a profound aversion to the high rise construction, and the accompanying influx of "two-dollar taxpayers."[1] Implied by transit extensions, the garish image of noisy migrant tenement dwellers, crowding bars and sidewalks around transit stations are not calculated to win the suburbanite's heart. Even if the picture is fantastically overdrawn, it is a fact that many suburban residents visualize transit extensions as importing mechanisms for the type of social patterns and problems which partially motivated their own departure from the central city.

The Next Phase: The Plan

From its inception, the Boston Regional Survey was designed as the foundation for a full-scale comprehensive planning effort, as the overture to preparation of a comprehensive plan for regional development. In July, 1962, the legislature voted the necessary funds to initiate a regional planning project and the MTC mass transportation demonstration program. The Bureau of Public Roads, the federal agency responsible for highway construction, and the Housing and Home Finance Agency which is responsible for administration of regional planning and other activities related to housing urban renewal and mass transportation, have joined in the MTC and State Department of Public Works financing a massive planning effort while the demonstration program is financed by MTC-HHFA funds. The planning and demonstration program will provide many of the answers to the problems of regional development, particularly those relating to transportation. Equally important, the integrated planning-demonstration experiment program includes an extremely close liaison with the decision-making process. If this effort is successful, the program could be a milestone in federal interagency cooperative efforts.

Community Advisory Council

In the fall of 1961 with research on the Boston Regional survey well under way, the Mass Transportation Commission devised a method of achieving direct contact with communities on a continuing basis. Mayors and selectmen of each of the 144 cities and towns in the region were requested to appoint three members to a Community Advisory Council.

The Community Advisory Council played an interesting, but minor role in the survey. An organizational meeting was held in December of 1961, to report to the communities on the MTC's research and objectives. In February and March of 1962, four meetings of the Community Advisory Council were held on a subregional basis. Two reports summarizing progress on the survey and indicating preliminary research findings were distributed to the communities and a questionnaire requesting a community statement on development and transportation was distributed in the early part of 1962. Attendance at the meeting ranged from moderate to sparse, and the replies to the questionnaires from the 144 cities and towns included in the Boston Regional Survey were sent in. Although only a quarter of the region's communities returned the questionnaire, the population represented by the questionnaire replies was 1.2 million, over a third of the region's total. As reflected in the questionnaires, major problems facing communities in the region included urban redevelopment, rising tax rates, need for improved mass transportation, and inadequate economic base.

In addition to the formal relationship between the MTC and the communities in the region through the Community Advisory Council the cities and towns of the region have made their views known on a variety of issues to the MTC throughout the course of the survey. Daily and weekly newspapers, community business, civic and political leaders and informed citizens have maintained close contact with the MTC. To a considerable extent the formulation of the MTC planning and demonstration experiments reflects community sentiments transmitted through the council, or through informal discussion. Moreover, without strong community support, the MTC program calling for the expenditure of $2.6 million in state funds would have had little chance of securing the overwhelming approval it achieved in the state legislature.

It would be reasonable to assess the community relations efforts under the Boston Regional Survey as only partially successful. Although the more articulate community representatives and residents made their views known without difficulty and often of great length, more intensive work will be needed to secure adequate responses from other elements in the cities and towns.

Another facet of the regional planning project is the development of a close working liaison with professional planners and other technicians in the region. This was attempted on a smaller scale in the survey.

Planning Directors Conferences

On a monthly basis, throughout the period of the study, meetings were held with professional planners employed by communities in the region and other parts of the state. At these meetings discussions were held on mutual problems and developments affecting planning and the survey itself. Meetings of a similar nature, but broader in scope and more extended in time have been scheduled to permit professional planners in the region to contribute significantly to the progress of the planning project.

In a direct sense, the planning program and the transportation experiments are the outgrowth of the Boston

1. This refers to the fact that unlike homeowners, renters contribute to local property taxes indirectly as a part of their rental charges and are required to pay a two dollar head tax to local communities.

Regional Survey. Each aspect of the planning and demonstration program was designed to meet a need which was identified in the course of the Survey. The broad scope and complexity of the planning-demonstration, however, makes it a unique phenomenon. Not only is it the largest program of its kind yet attempted in the nation but it represents a promising attempt to develop a comprehensive advanced research and implementation program which have thus far eluded efforts undertaken in other areas.

CHAPTER ONE — POPULATION AND LAND USE

POPULATION

1. REGIONAL SIZE AND COMPOSITION

Population size and growth trends have been widely used as measures of economic and social vitality in such diverse fields as anthropology and market analysis. In most western countries growing economic prosperity and political power has usually been accompanied by rapidly expanding population. In United States communities and metropolitan areas there seems to be a positive correlation between the rate of population expansion and economic growth. As the basic element in community and regional analysis, population is accorded first place in a sequence of inventory studies.

A. *Boston and Other Major Areas*

In 1960 the total population of the Boston Metropolitan Region[1] was 3.3 million persons, two-thirds of the state population and one-third of the population of New England. The Boston SMSA,[2] which contains the bulk of the region's population, contained one out of every 44 people who resided in the nation's 212 SMSA's in 1960.[3]

Within New England the Boston area's leadership is unchallenged. The nearest competitors are the Providence SMSA with 800,000 people and Hartford and Springfield-Holyoke with approximately half a million persons each.

The Boston Metropolitan Region is a part of the Atlantic Urban Region, or "Megalopolis", a 400 mile band of nearly continuous urban territory reaching from southern New Hampshire to northern Virginia. This urban belt contains 35 of the nation's 212 SMSA's including New York, Philadelphia, Washington, Baltimore, and Boston in the over-one-million category and a dozen others in the 200,000 to 800,000 population range.

As shown in Table 2, the other three metropolitan areas in the Boston Metropolitan Region are very much smaller than the Boston SMSA. The largest of the three, the Lawrence-Haverhill area (which includes 12,000 people in two adjacent New Hampshire communities), contained a population of almost 190,000 in 1960. Population in both the Lowell and Brockton SMSA's was approximately 150,000. The expanse of territory in the outer parts of the region also includes eight towns on the fringes of the Worcester and Providence SMSA's.

TABLE 1

POPULATION OF THE EIGHT LARGEST STANDARD METROPOLITAN STATISTICAL AREAS IN THE UNITED STATES, 1960

SMSA	Population (millions)
New York	10.7
Los Angeles	6.7
Chicago	6.2
Philadelphia	4.3
Detroit	3.8
San Francisco-Oakland	2.8
BOSTON	2.6
Pittsburgh	2.4

Source: ***U.S. Census of Population, 1960.***

TABLE 2

POPULATION DISTRIBUTION WITHIN THE BOSTON METROPOLITAN REGION BY SMSA's, 1960

Area	Population (nearest 000)	Per Cent of Region
Boston SMSA	2,590,000	77.4%
Brockton SMSA	149,000	4.5
Lawrence-Haverhill SMSA[1]	175,000	5.2
Lowell SMSA	158,000	4.7
Remainder of Region	274,000	8.2
Boston Metropolitan Region	3,346,000	100.0

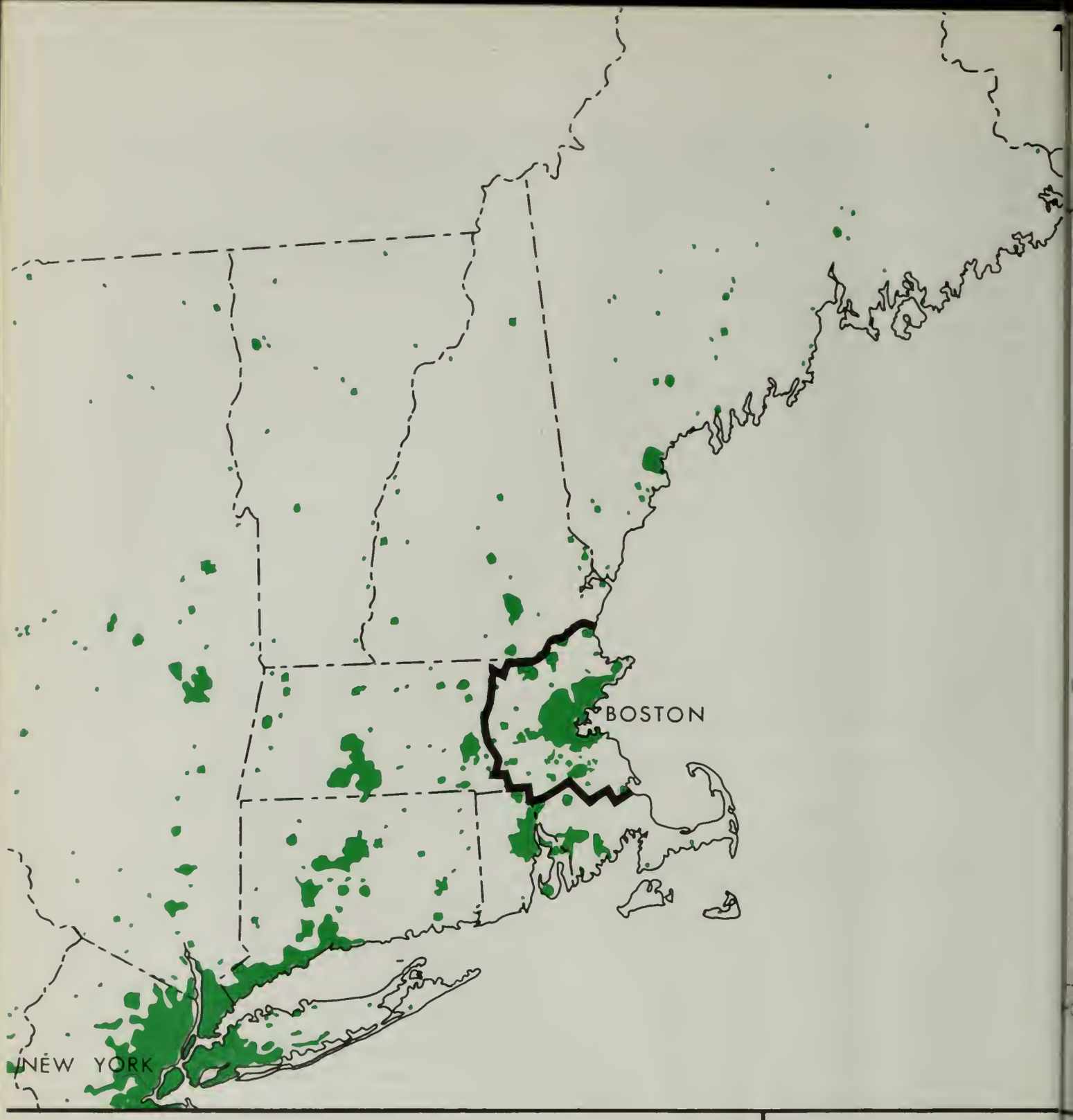
1. Excluding two New Hampshire towns, Salem and Plaistow, combined population 12,000.

Source: ***U.S. Census of Population, 1960.***

B. *SMSA Boundaries and Population Levels*

Between the 1950 and 1960 Censuses the boundaries of each of the four principal metropolitan areas in the Boston Metropolitan Region were changed but these changes had a significant effect on population levels in only one: the Lawrence metropolitan area, containing four municipalities in 1950, was extended in 1960 to include a second city, Haverhill, and the town of Groveland, as well as two towns in New Hampshire, with the result that its 1960 population was

1. The Boston Metropolitan Region, as defined for purposes of this survey, includes 144 cities and towns in eastern Massachusetts, virtually all of four Standard Metropolitan Statistical Areas, and small parts of two others, as shown on Figure 2.
2. SMSA is the abbreviation for Standard Metropolitan Statistical Area.
3. The Standard Metropolitan Statistical Area in New England, as defined by the Bureau of the Census, consists of a group of towns which contain at least one city of 50,000 population or more or two contiguous cities with a combined population of 50,000 or more. Towns are included in an SMSA on the basis of the degree of their integration with the central city. For an explanation of the criteria for SMSA'S, see the Introduction to the 1960 Census of Population, Vol. 1.



NORTHEASTERN URBAN AREAS, 1960

NORTH

625 SQ. MILES

25 0 25 50

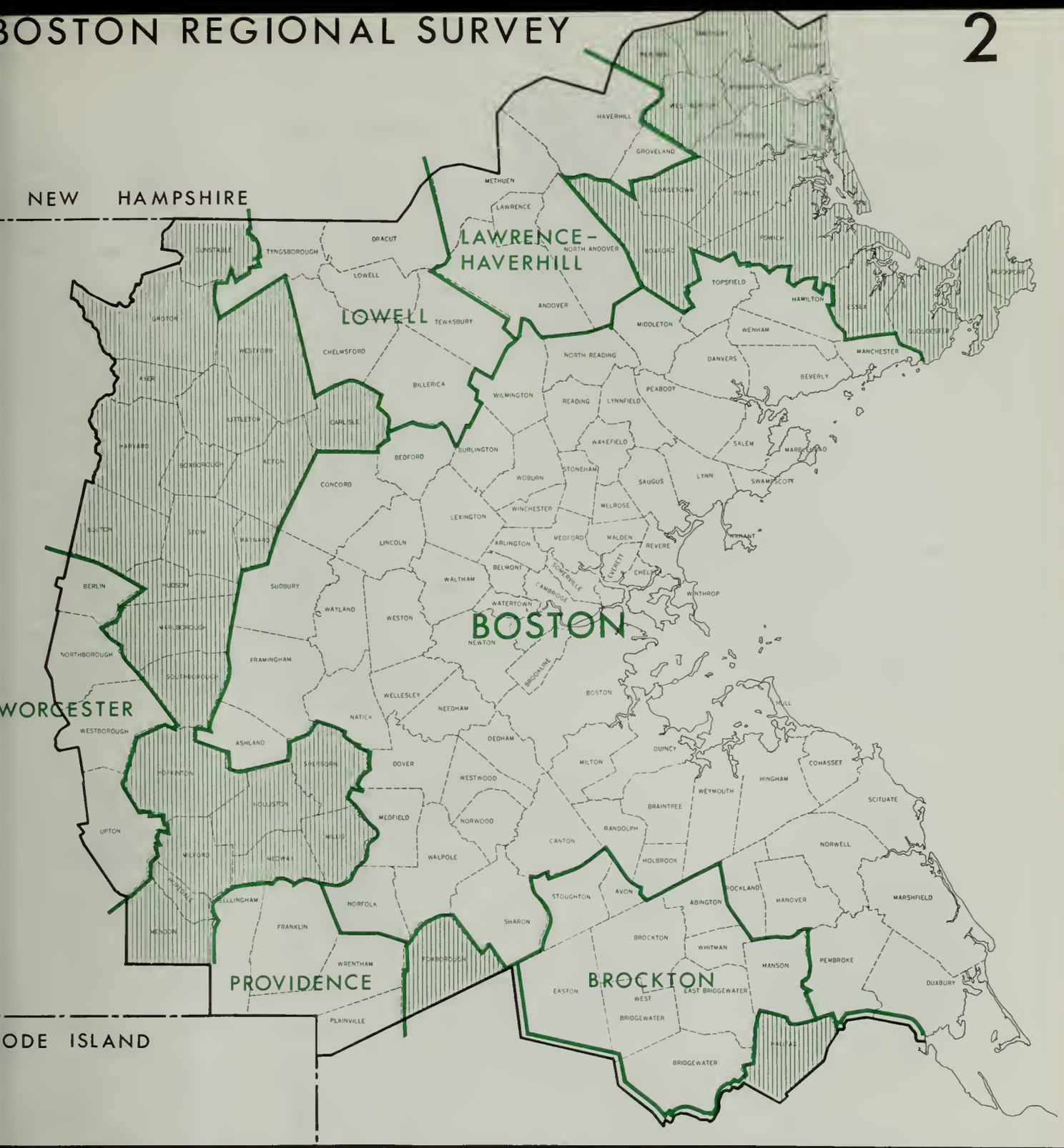
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BY THE PLANNING SERVICES GROUP CONSULTANTS

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BOSTON REGIONAL SURVEY

2



STANDARD METROPOLITAN STATISTICAL AREAS, 1960

AREAS NOT INCLUDED IN SMSA

SOURCE: US CENSUS

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◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 2560 ACRES

SQUARE MILES

0 5 10 MILES

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far greater than it would have been had the 1950 boundaries of the four-community Lawrence SMSA been retained. The Lowell metropolitan area experienced a relatively minor extension in the addition of the town of Tyngsborough (population 3,000) to its area. The Boston SMSA gained 11 communities with 76,000 residents in 1960. Of these, two towns were added to its area (with about 23,000 people) which were removed from the 1950 Brockton metropolitan area. In turn, the Brockton area added one town with a 1960 population of about 4.000. This complex pattern of changes in metropolitan area boundaries is shown in Figure 3.

Further changes in metropolitan area definitions, even more sweeping in character, may be forthcoming in future years. For example, it is conceivable that by 1970 a new Merrimack Valley SMSA, including an expansion of the present Lawrence-Haverhill and Lowell areas, may be delineated by the Bureau of the Census. Furthermore, since the Merrimack Valley, along with the Brockton SMSA, will undoubtedly become even more closely linked to the Boston area, and as a result, by 1970 the four SMSA's in the region (as well as additional territory) may well be grouped by the Bureau of the Census as a single urban zone, as large or larger than the region delineated in this study.

2. GROWTH TRENDS

The most significant trend relative to population growth in the Boston Metropolitan Region is its comparatively slow rate of expansion. Between 1940 and 1960 the region as a whole increased by only 528,000 persons or about 19%, only about half the national gain of 36% in that twenty year period.

Between 1940 and 1960, growth in the Boston SMSA was substantially lower than in other major metropolitan areas, including the New York and Philadelphia SMSA's. Within New England, two Connecticut Valley centers, the Hartford area and the Springfield-Holyoke area, have grown faster than the Boston SMSA.

Until recently, population expansion has been extremely slow in the three smaller SMSA's within the Boston region. Neither of the two Merrimack Valley areas nor the Brockton area exhibited significant growth in the 1940-1950 decade. However, the Lowell and Brockton areas, which are increasingly developing a suburban dormitory relationship to the Boston core, gained substantially in population between 1950 and 1960, far outstripping the low growth rate of the Lawrence-Haverhill area.[4] Since Lawrence-Haverhill is also linked to Boston by excellent highways and also posses-

4. The Brockton, Lowell and Lawrence areas have all experienced serious unemployment problems in the past two decades. An increasing proportion of their labor force is employed in the Boston SMSA. This is one reason for including these SMSA's in the enlarged Boston region as defined in this study.

TABLE 3

POPULATION CHANGE IN SELECTED NORTHEASTERN SMSA's, MASSACHUSETTS AND THE TOTAL UNITED STATES FROM 1940 to 1960

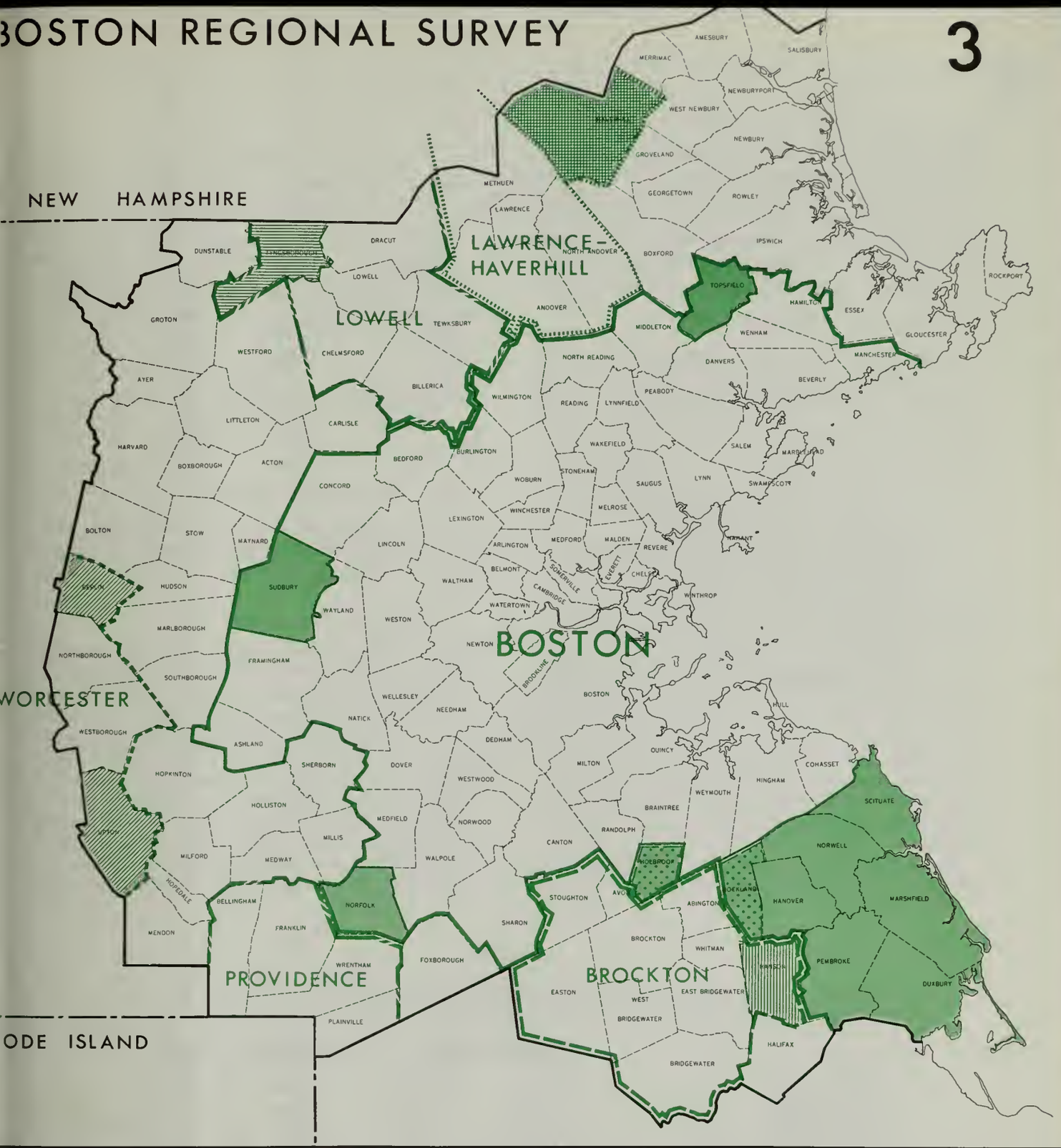
Area		Numerical Increase 1940-1960	Per Cent Change 1940-1950	Per Cent Change 1950-1960
Boston Region SMSA's				
	Boston[1]	+ 380,000	+ 9.1%	+ 7.4%
	Brockton	+ 39,000	+ 8.4	+24.8
	Lawrence-Haverhill[2]	+ 1,700	+ 1.1	— 0.1
	Lowell	+ 25,400	+ 2.5	+16.2
	Remainder of Boston	+ 82,200	+12.5	+27.0
	TOTAL BOSTON METROPOLITAN REGION[3]	+ 528,300	+ 8.5%	+ 9.4%
Other Northeastern SMSA's				
	Providence-Pawtucket	+ 121,000	+ 9.3%	+ 7.4%
	Springfield-Holyoke	+ 107,000	+11.2	+15.7
	Hartford	+ 188,000	+20.6	+29.2
	New York	+ 1,988,000	+ 9.8	+11.9
	Philadelphia	+ 1,143,000	+14.7	+18.3
	Massachusetts (11 SMSA's)	+ 762,000	+ 8.4%	+ 8.3%
	United States (212 SMSA's)	+40,000,000	+22.6%	+26.4%

1. In evaluating population changes for the 1940-1950 decade it must be remembered that the tens of thousands of out-of-town students attending the Boston area institutions (as well as hospital patients and military personnel) were included in area population counts beginning in 1950. Consequently, the 1940-1950 increase for the SMSA is overstated, possibly by as much as 3.5%. This factor also applies to other SMSA's but with less proportionate effect on population percentage figures.
2. Excluding two New Hampshire towns, Salem and Plaistow combined population 12,000.
3. The regional numerical increase is overstated by 300 persons because of rounding.

Source: *U.S. Census of Population, 1960.*

BOSTON REGIONAL SURVEY

3



METROPOLITAN AREA CHANGES, 1950 – 1960

AREA	BOUNDARY 1950	BOUNDARY 1960	GAINS	LOSSES
BOSTON				
BROCKTON				
LAWRENCE				
LOWELL				
PROVIDENCE				
WORCESTER				

SOURCE: US CENSUS

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NORTH

1 = 2560 ACRES SQUARE MILES

0 5 10 MILES

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ses an abundance of attractive residential sites, this area may experience similar suburban growth in coming years.

The fastest growth of any part of the Boston Metropolitan Region in the 1950-1960 period occurred in the parts of the region *not* included in the four principal metropolitan areas. The outlying territory grew by 27% in the decade, rising from 216,000 to 274,000 persons.

A. *Central City Population Trends*

Boston was the third largest city in the nation in 1850 and by 1900 was still fourth in size. However, by 1950 it declined to tenth place and by 1960 slipped to thirteenth. One of the major reasons for Boston's relative decline was its inability to engage in large scale annexation of surrounding territory. For example, the city of Boston contained only 26% of its SMSA population in 1960 as compared to New York and San Francisco's 40% and Philadelphia and Detroit's 45%.

Between 1850 and 1910 the city of Boston grew rapidly in population. The rate of increase slowed considerably thereafter and in the 1950-1960 decade a very sizeable population decline occurred. The net result of five decades of population change was to scale back Boston's 1960 population to roughly the same level as in 1910. Much the same trend held true for the cities of Somerville, Cambridge, Lynn, and Chelsea and also for the outlying cities of Lawrence, Lowell, Haverhill, and Salem. Brockton was an exception to the rule; its large amounts of open land, proximity to a new expressway, and a city government willing to work closely with developers led to a substantial increase in population between 1950 and 1960 after three decades of population stability.

As can be seen by comparing Tables 3 and 4, central city decline coupled with metropolitan area growth occurred in many areas in the 1950-1960 decade. However, the 1950-1960 percentage decline in the site-poor city of Boston was greater than in any other major city.

TABLE 4

SELECTED CENTRAL CITY POPULATION TRENDS, 1950-1960

Central City	Population (in 000's) 1950	1960	Per Cent Change 1950-1960
BOSTON	801	697	—13.0%
Providence	330	288	—12.6
Pittsburgh	677	604	—10.7
Detroit	1,850	1,670	— 9.7
Hartford	177	162	— 8.6
San Francisco	1,160	1,108	— 4.5
Philadelphia	2,072	2,003	— 3.3
Chicago	3,621	3,550	— 1.9
New York	7,892	7,782	— 1.4

Source: *U.S. Census of Population, 1960.*

B. *Natural Increase and Migration*

The fact that its population growth has been only moderate over the period 1940-1960 indicates that the Boston Metropolitan Region has been a net exporter of population. This has been true even though the region's birth rate has run consistently lower than the national average and its death rate has been somewhat higher. In consequence, its natural increase rate, or the difference between birth and death rates, has been about 10% below the U.S. average. Had the region as a whole "captured" its natural increase instead of losing some of it through net out-migration, it might have experienced a population gain of about 300,000 persons between 1940

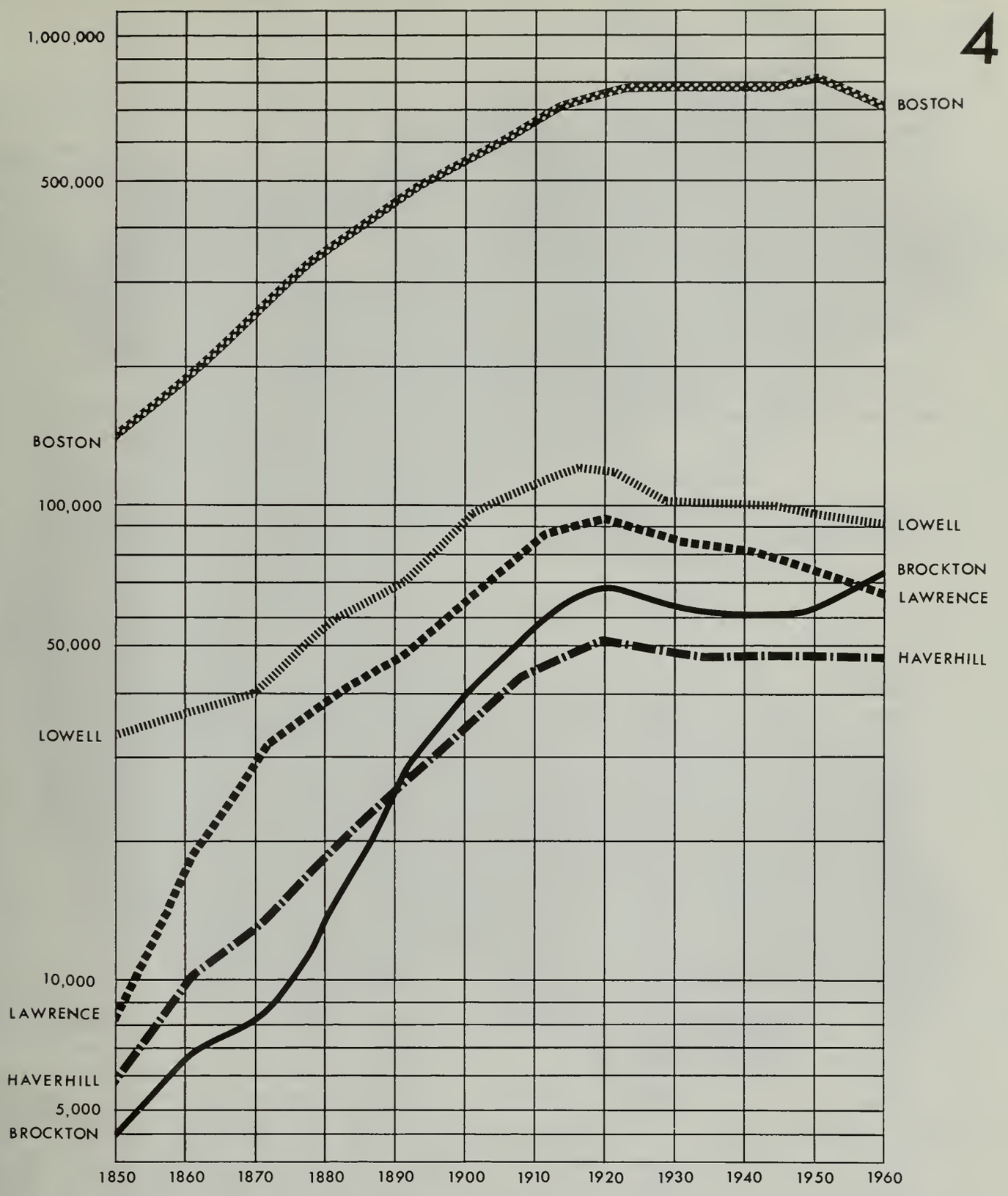
TABLE 5

POPULATION GROWTH AND ESTIMATED NET MIGRATION IN THE BOSTON METROPOLITAN REGION, 1940-1960

Area	Population Growth 1940-1950	1950-1960	Estimated Net Migration 1940-1950	1950-1960
Boston SMSA	+201,000	+179,000	—30,000	—100,000
Brockton SMSA	+ 9,300	+ 29,700	— 1,000	+ 15,000
Lawrence-Haverhill SMSA[1]	+ 1,800	— 100	—13,000	— 14,000
Lowell SMSA	+ 3,400	+ 22,000	—11,000	+ 2,000
Remainder of Region	+ 23,900	+ 58,300	— 2,000	+ 25,000
Boston Metropolitan Region[2]	+239,400	+288,900	—62,000	— 75,000

1. Excluding two New Hampshire towns, Salem and Plaistow, combined population 12,000 in 1960.
2. The regional numerical total is over-stated by 300 persons in the 1950-1960 period because of rounding.

Source: U.S. Census and MTC consultant estimates. The estimates were arrived at by applying average natural increase rates to the population base and computing the estimated population figure. The population base for 1940 does not include students but that for 1950 does, causing a relative overstatement in population for 1950 and an understatement in migration for the 1940-1950 period. The migration estimates for the 1940-1950 period were adjusted to account for this differential.



POPULATION TRENDS IN CENTRAL CITIES OF BOSTON METROPOLITAN REGION, 1850-1960

SOURCE: U.S. CENSUS

and 1950 and another 350,000 between 1950 and 1960; actual regional gains were approximately 240,000 and 290,000 in the two decades. (See Table 5.) Undoubtedly the Boston SMSA's sizeable 1950-1960 net outmigration was in part responsible for the net influx of population in other parts of the region, particularly in suburban areas. In addition, some in-migration from the Providence and Worcester areas probably occurred in the outlying towns.

3. POPULATION DISTRIBUTION

The basic distribution of the region's population has not been fundamentally changed by the continuing trend toward decentralization. A substantial proportion of the region's population continues to dwell in the long-established urban centers.

Only one of the region's major urban centers, Brockton, gained population from 1950 to 1960, but virtually every suburban and outlying town posted sharp gains. The fastest rates of growth occurred in formerly rural or exurban communities on the fringes of the metropolitan area, but their large percentage gains tends to obscure the fact that the greatest numerical increases were found in the suburbs close to the major urban centers.

TABLE 6

POPULATION DENSITY OF SELECTED COMMUNITIES IN THE BOSTON METROPOLITAN REGION, 1960

	Density (persons per square mile)	Public Transit Service[1]
Boston SMSA		
Somerville	23,100	MTA F
Cambridge	17,100	MTA RT
Boston	14,600	MTA RT
Chelsea	14,100	MTA RT
Everett	13,200	MTA RT
Malden	12,000	MTA F
Winthrop	11,900	
Arlington	9,800	MTA F
Watertown	9,300	MTA RT
Lynn	9,100	
Medford	8,000	MTA F
Brookline	7,900	MTA RT
Revere	7,200	MTA RT
Belmont	6,200	MTA F
Melrose	6,200	
Newton	5,300	MTA RT
Quincy	5,200	
Salem	4,900	
Swampscott	4,400	
Waltham	4,100	
Milton	2,000	MTA RT
Other SMSA's		
Lawrence	9,900	
Lowell	7,000	
Brockton	3,400	
Haverhill	1,400	

1. MTA RT indicates a community in the MTA district served by rapid transit lines; MTA F is a community in the district served only by surface feeder routes.

Source: *U.S. Census, 1960,* and Massachusetts Department of Commerce.

A. *Density of Population*

One result of the pattern of decentralization has been a reduction of population densities in the densely settled core and an increase in the density of population in lightly populated areas.

Population density in the central cities of the Boston SMSA is in excess of 10,000 persons per square mile, while densities in other parts of the core (e.g., Arlington and Belmont) range between 5,000 and 10,000 persons per square mile. Beyond the urban core in the first ring of suburban towns (Dedham, Lexington, etc.) density decreases to the 1,500-2,500 persons per square mile range, and in outlying towns population densities fall off to 1,000 or fewer persons per square mile. This progressive decline of population densities from the core outward is interrupted by the region's other urban centers, located along the main lines of population movement. These have moderate to high (3,000-10,000 persons per square mile) population densities. All of the communities with densities over 4,000 persons per square mile (save for Lawrence and Lowell) are in or near the core portions of the Boston SMSA.

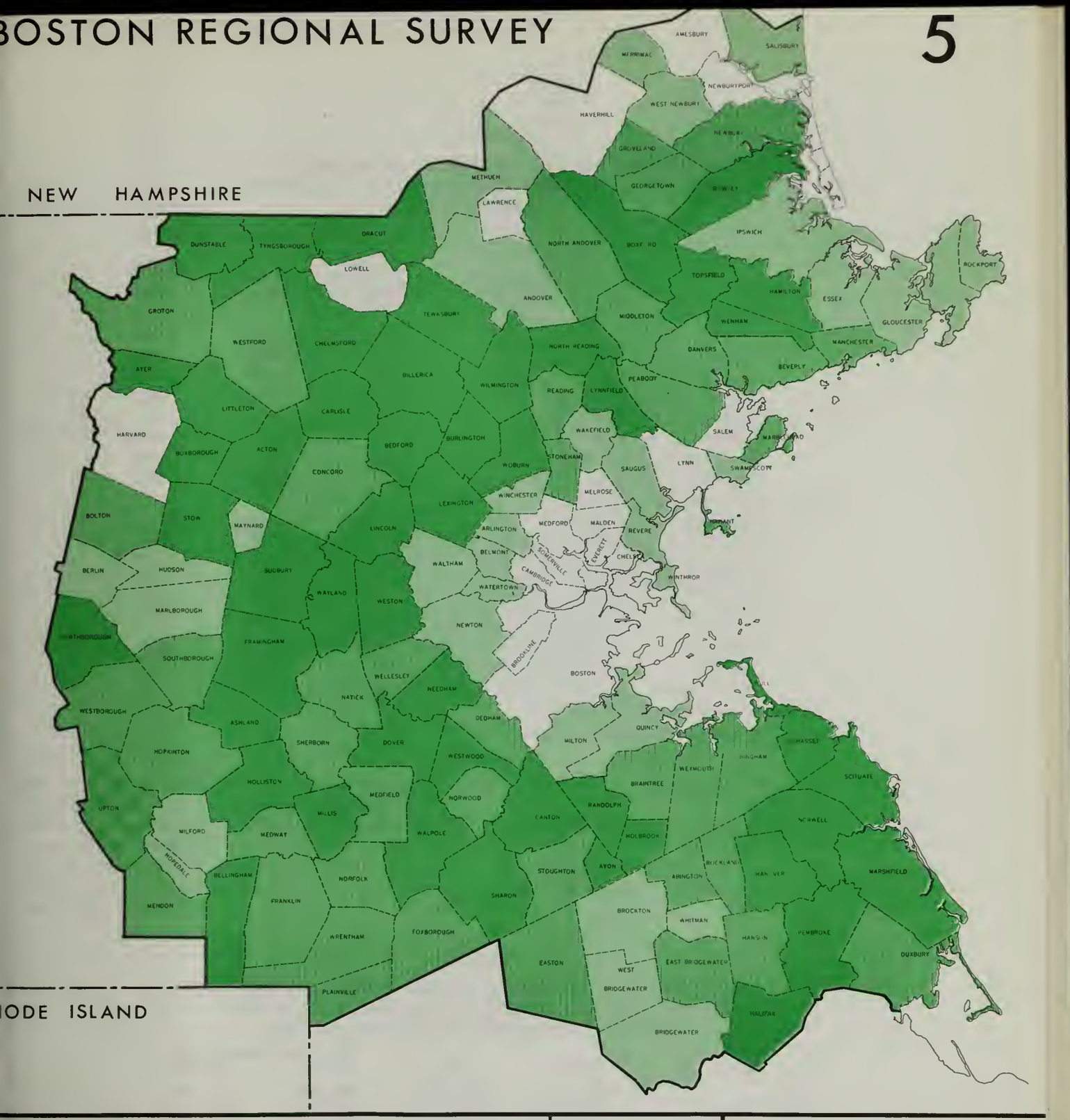
Nearly all of the densely populated communities are served by the Metropolitan Transit Authority. The exceptions are Lynn and Winthrop, both with a density over 5,000 persons per square mile. The only MTA served community with a density of less than 5,000 persons per square mile is Milton. Since a large part of Milton is taken up by the Blue Hills Reservation, in this instance, the average density figure (population divided by total land area) tends to be misleading.

Population densities for a number of Standard Metropolitan Statistical Areas are presented in Table 7. Included are most of the nation's SMSA's which now have or are planning to install rapid transit systems.

New York, which has the most complete rapid transit system in the nation, has an SMSA population density almost double that of the Boston area. But Boston's SMSA density is double that of Philadelphia and San Francisco and higher than that of Chicago and Detroit. Philadelphia has a sizeable transit system, Cleveland has a small rapid transit service, and a large scale, billion-dollar system has been proposed for the San Francisco area.

BOSTON REGIONAL SURVEY

5



PER CENT CHANGE IN POPULATION, 1950 - 1960

- DECLINE
- UNDER 25% GAIN
- 25% - 49.9% GAIN
- OVER 50% GAIN

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NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

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TABLE 7

LAND AREA AND GROSS POPULATION DENSITY IN SELECTED STANDARD METROPOLITAN STATISTICAL AREAS, 1960

Area	Land Area in Sq. Miles	Population per square mile of land area: SMSA's	Central Cities	Outside Central Cities
Boston Region SMSA's				
Boston	970[1]	2,670	14,590	2,050
Brockton	160	910	3,390	540
Lawrence-Haverhill	160	1,150	2,990	570
Lowell	120	1,280	7,030	600
Selected New England SMSA's				
Providence-Pawtucket	630	1,290	10,890	870
Springfield-Holyoke	430	1,120	3,890	540
Hartford	510	1,020	9,320	730
Selected SMSA's outside of New England				
New York	2,150	4,980	24,700	1,590
Washington, D. C.	1,490	1,350	12,440	870
Philadelphia	3,550	1,220	15,740	690
Detroit	1,970	1,920	11,960	1,150
Chicago	3,710	1,680	15,840	770
Cleveland	690	2,610	10,790	1,520
Atlanta	1,720	590	3,800	330
San Francisco	3,310	840	11,010	520

1. All figures rounded.

Source: *U.S. Census of Population, 1960.*

4. POPULATION PROJECTIONS

Based on GBESC projections, the locus of the region's population growth is expected to shift increasingly to the outer suburbs, which are projected to grow by 21% over 1960, slightly greater than the gain of 18% projected for the inner suburbs.

Shown in Table 8 is a simple extrapolation to 1980 of the 1950-1960 population increase and the 1960-1970 trends projected by GBESC. This assumes (1) a continuation of the region's 10% per decade rate of expansion, (2) continued population decline in the core, (3) which is more than counterbalanced by gains in the inner and outer suburbs. As compared to 1950 popu-

TABLE 8

POPULATION OF THE CORE CITIES, INNER SUBURBS AND OUTER SUBURBS OF THE GBESC STUDY AREA FOR 1950 and 1960 PROJECTED TO 1970 and 1980

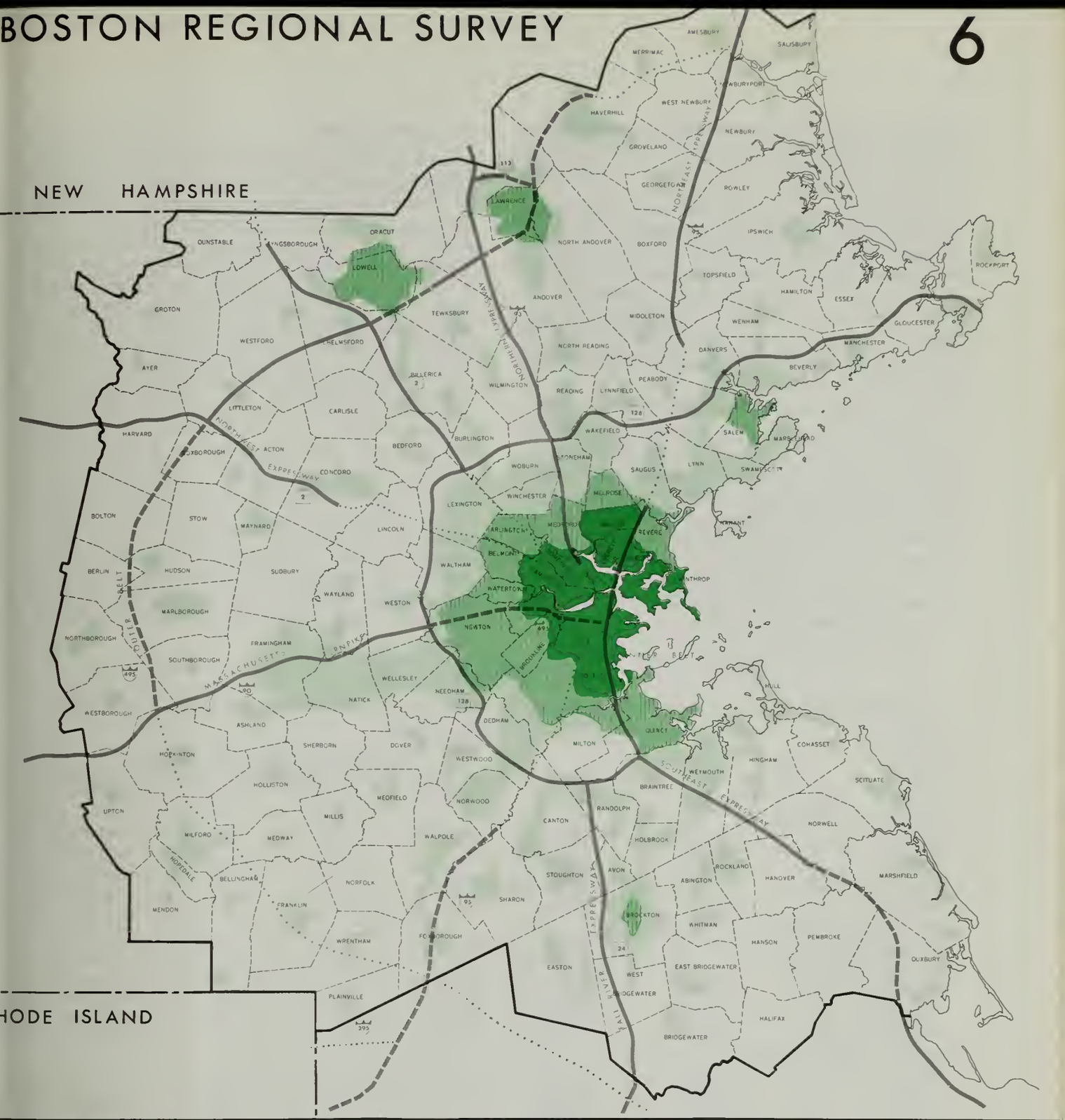
Area[1]	1950	1960	Projected 1970	Extrapolation to 1980
Core	1,431,000	1,303,000	1,209,000	1,124,000
Inner Suburbs	817,000	1,028,000	1,191,000	1,381,000
Outer Suburbs	883,000	1,405,000	1,338,000	1,619,000
TOTAL	3,131,000	3,436,000	3,738,000	4,124,000

1. The GBESC study area is defined in Figure 10. The core consists of 12 cities and towns, the Outer Suburbs, including Brockton, Haverhill, Lawrence and Lowell, consists of 96 cities and towns with the total study area consisting of 149 cities and towns.

Source: The 1950-1970 data from: GBESC, *The Population of the Cities and Towns of Greater Boston Projected to 1970*, Economic Base Report No. 4, (December, 1959) and GBESC, *Revised 1970 Population Projections of the 149 Cities and Towns in the GBESC Area*, (February, 1961). The 1980 extrapolation is by the MTC planning consultant.

BOSTON REGIONAL SURVEY

6



POPULATION DENSITY, 1960

- NON-URBANIZED AREAS
- UNDER 5,000 PERSONS PER SQUARE MILE
- 5,000 - 10,000 PERSONS PER SQUARE MILE
- OVER 10,000 PERSONS PER SQUARE MILE

SOURCE: ESTIMATED FROM GBESC AND CENSUS DATA

GENERAL INFORMATION

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NORTH

SQUARE MILES (1 = 2560 ACRES)

0 5 10 MILES

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lation levels, this extrapolation would result in the outer suburbs nearly doubling in population, the inner suburbs increasing by almost half, and the core declining at a slow, steady pace.

The extent to which this overall pattern of regional population change can or will be altered in the future is one of the important questions facing the Boston Metropolitan Region. Continued decentralization will inevitably result in a region heavily dependent on the motor vehicle and with declining patronage of mass transit. Moreover, it is conceivable that the economic vitality of the core may be damaged by continuing population losses.

5. POPULATION CHARACTERISTICS

Generally, population characteristics in the Boston Metropolitan Region are similar to those of other major SMSA's. Family incomes, labor force participation rates, age composition, and levels of educational attainment bear a fairly close resemblance to patterns which prevail in many of the nation's largest urban centers. However, the region's ethnic and racial composition differs considerably from other large SMSA's. Also, as is the case in other metropolitan areas, wide differences occur within major sub-areas of the region.

A. *Income Patterns*

Based on Census data, median incomes in the Boston SMSA run about 10% higher than those in the three other SMSA's in the Boston region and are substantially above the national average. As can be seen in Table 9, Boston area incomes are approximately equal to those in Philadelphia and New York but are below the levels in Hartford. Hartford is among the highest income areas in the nation. The relatively low income levels displayed by the Boston region's outlying urban areas, Lawrence-Haverhill, Lowell, and Brockton, is related to their comparatively high unemployment rates and traditional domination by unstable, low wage industries.

Since they contain a high proportion of lower income families, incomes in the central cities run far below levels in such high income suburbs as Newton and Wellesley. Incomes in Brookline, a community which is virtually surrounded by Boston, are among the highest in the region. The inability of the city of Boston to annex adjacent territory has tended to restrict its income level to the low-to-moderate end of the scale. Any sizeable construction of luxury apartments might have a major impact in expanding Boston's relatively small upper income group. Even a limited number of

TABLE 9

INCOME PATTERNS IN BOSTON METROPOLITAN REGION SMSA's AND OTHER SELECTED AREAS IN 1949[1] and 1959

Area	Median Family Income 1949	Median Family Income 1959	Per Cent of Families With Income Under $3,000 1949	$10,000 and Over 1949	Under $3,000 1959	$10,000 and Over 1959
Boston Region SMSA's						
Boston	$3,516	$ 6,687	34.1%	4.3%	11.0%	21.3%
Brockton	3,143	6,117	43.1	1.9	10.8	13.0
Lawrence-Haverhill	3,141	6,068	44.4	1.9	14.4	13.3
Lowell	3,086	6,047	45.2	2.0	12.6	12.6
Other Selected SMSA's						
Providence-Pawtucket	3,170	5,688	42.8	2.4	15.6	11.9
Springfield-Holyoke	3,448	6,235	34.8	2.3	12.2	14.9
Hartford	3,830	7,187	29.4	4.6	8.7	23.5
New York	3,640	6,548	33.7	5.6	13.2	22.2
Philadelphia	3,466	6,433	35.9	3.8	13.0	19.1
Selected Cities and Towns						
Boston	3,249	5,747	40.2	2.3	16.7	13.6
Brockton	3,109	5,914	43.9	2.1	12.6	12.2
Brookline	na[2]	8,380	na[2]	na[2]	8.7	40.2
Chelsea	3,149	5,298	43.4	1.9	19.0	9.1
Lawrence	3,048	5,508	46.8	1.0	18.5	8.7
Lowell	3,063	5,679	46.0	2.2	15.5	11.6
Newton	4,768	9,008	21.4	16.8	6.0	43.8
Wellesley	na[2]	11,478	na[2]	na[2]	4.8	57.2
United States	3,073	5,660	46.0%	3.0%	21.4%	15.1%

1. The 1949 data are for Standard Metropolitan Areas.
2. Not applicable.

Source: *U.S. Census of Population, 1960* and *1950.*

developments, such as Charles River Park, might increase the number of families in the $10,000 and over category appreciably. This could conceivably have a significant effect not only on the city's income pattern but also on its political and social structure.

Although Boston has tended to evolve into a primarily low-to-middle income community over past decades it must be recognized that the city still contains a wider income spectrum than the smaller communities on its borders. For example, 13.6% of the families in Boston were reported to have incomes in excess of $10,000 annually in 1960 as compared to only 9.1% in Chelsea. At the other end of the scale are the highest income communities, Brookline and Wellesley, where 40% and 57%, respectively, of the families receive more than $10,000 annually.

The percentage of regional families with incomes above $6,000 a year, the amount estimated to be needed to finance a modest $13,000-$16,000) suburban house, has been steadily rising. Nevertheless, in the region's central cities, half of the families still had incomes below $6,000 in 1959. A continuing trend toward income segregation is evident, with higher income families clustering in suburban locations, leaving central city areas to low-to-medium income groups. Large lot zoning, increasingly common in the suburbs, tends to raise land prices and hence helps to exclude low income families. A limited number of higher income families have been locating in new central city dwellings, particularly in high rent ($60 plus per room) structures. (In part, this counter movement is the result of upgrading, as in the privately financed regeneration in the Back Bay area, or in the outgrowth of renewal activities such as Charles River Park, where low-income families in low rent quarters have been replaced by high income families in high rise apartments.)

Incomes in the Boston region have tended to rise substantially in past years. Real per capita income in the region probably increased by over a third between 1950 and 1960. Should this trend continue, real income may more than double in the next twenty to thirty years. An increase of this magnitude could be expected to have numerous effects on retail sales volume, automobile ownership and use, housing, and other aspects of regional development.

The way in which the additional income is allocated will be highly significant for regional development. Clearly one effect will be to broaden the range of personal housing and transportation choices available to the region's residents.

B. *Ethnic Composition*

a. *The Foreign Born*

The Boston Metropolitan Region resembles other eastern metropolitan centers in its high proportion of foreign born persons. These proportions, however, have been declining in almost all urban areas due to a relatively small foreign immigration. Also, many of the foreign born already in the country are reaching the end of their life span.

The total proportions of the population with first or second generation foreign origins form a significant segment of the population in the Boston and Lawrence SMSA's. Brockton and Lowell are approximately 5% lower in this criterion.

b. *Foreign Stock*

The 1960 census of population combined native population of foreign or mixed parentage into a single category termed "foreign stock." This category comprises first and second generation Americans. Third and subsequent generations are included as "native of native parents."

Because of the limitation to first and second generation, the census definition is inadequate as a guide to ethnic composition in the region. This is particularly true of persons of Irish ancestry, many of whom identify

TABLE 10

FOREIGN BORN POPULATION IN THE BOSTON METROPOLITAN REGION AND OTHER SELECTED AREAS, 1950 and 1960

Area	Total Population: Per Cent Foreign Born[1] 1950	1960	Per Cent Native of Foreign or Mixed Parentage 1960
Boston Region SMSA's			
Boston	16.2%	12.4%	29.4%
Brockton	12.7	8.7	25.0
Lawrence-Haverhill	20.1	12.4	32.1
Lowell	14.5	8.9	23.9
Other Selected SMSA's			
Springfield-Holyoke	14.5%	10.2%	28.0%
Hartford	15.4	11.6	27.7
New York	19.5	17.4	28.4
Philadelphia	8.2	6.8	18.2
Selected Cities and Towns			
Boston	18.0%	15.8%	29.7%
Cambridge	16.0	15.2	28.4
Chelsea	23.2	17.4	33.5
Haverhill	14.5	10.2	27.7
Lawrence	21.3	16.1	36.8
Newton	13.0	11.8	32.4

1. The 1950 percentages refer to the foreign born white population as a per cent of the total population and are for Standard Metropolitan Areas. The 1960 percentages refer to the white and non-white foreign born population as a per cent of the total population.

Source: *U.S. Census of Population, 1960; Advance Reports* and *U.S. Census of Population, 1950.*

themselves as members of that group although their original family emigration may date back to the famine of the 1850's. To a lesser extent, this is also true of persons of German stock who may trace their ancestry to the post-revolutionary exodus after 1848 and to French-Canadians whose ancestors may have entered the United States more than a century ago.

All told, approximately 1.2 million persons — more than a third of the region's population — are of foreign stock. The leading foreign country of origin is Canada, with over 300,000 migrants. The region has been a major center of Canadian immigrants. French-Canadians staffed many of the Merrimack Valley textile mills and Brockton shoe factories. English Canadians, particularly from the depressed Maritime Provinces, migrate to Boston. Other major countries of origin include Italy with 225,000 and Ireland with about 200,000. Central and eastern European countries (U.S.S.R., Poland, Austria, Hungary, Rumania, Lithuania) account for another 200,000, most of whom are probably Jewish.

The ethnic composition of the metropolitan areas differs markedly. Boston is a center of Irish, English-Canadian, Italian and central-east European stock.

In the Brockton, Lawrence-Haverhill and Lowell areas Canada is the leading country of origin, accounting for from a quarter to a half of the total. Irish and central-east European stock accounts for only 10% of the foreign stock in the three outlying metropolitan areas. Italy is the source of a fifth of the foreign stock in Lawrence-Haverhill, but is of lesser importance in Brockton and Lowell.

The political representation of the region and the state as a whole to a considerable extent reflects this ethnic composition. Political leadership has been contested by contenders of Irish and native Yankee ancestry for the past two generations. The Irish were able to secure a strong political position because of their coherent self-identity, their relatively early immigration, knowledge of the English language, and legal procedures which permitted the Irish to act as political interpreters and leaders for other nationalities. In recent years, however, there has been a tendency for persons identified with other ethnic groups to be accorded prominent places on the party tickets as is evidenced, for example, by the fact that the last two governors of the state are of Italian extraction.

Residences of second generation nationality groups were widely dispersed in 1950 and even more widely diffused in 1960. There seem to be few barriers to suburban movement of the foreign born throughout most parts of the Boston Metropolitan Region. The primary limitations to diffusion on the part of white persons, of all nationality groups, are inclination and income. Although family, ethnic, and neighborhood loyalties hold many foreign born persons to central city and other urban locations, the numbers of such persons seem to be diminishing. This is true even in such stable areas as the Italian-settled North End of Boston. In the Boston region as elsewhere in the nation, higher incomes and an accelerating process of cultural homogenization have greatly reduced the size and number of foreign born settlements, foreign language newspapers, and radio stations. Relocation to the suburbs signifies to many the achievement of higher incomes and the fulfillment of a desire to identify with the middle class. As ethnic ties are weakened and income rises, choice rather than necessity increasingly determines residential location.

c. *Non-White Population*

In contrast to the foreign stock, a substantially different picture emerges with respect to the non-white population of the region, which tends to be restricted to housing ghettos regardless of income levels. This is not a major factor in the region's development pattern, however, since non-whites constitute less than 3% of the region's population, 87,000 persons out of a total of 3.3 million. This is a far smaller proportion than in other major metropolitan areas, as shown in Table 11.

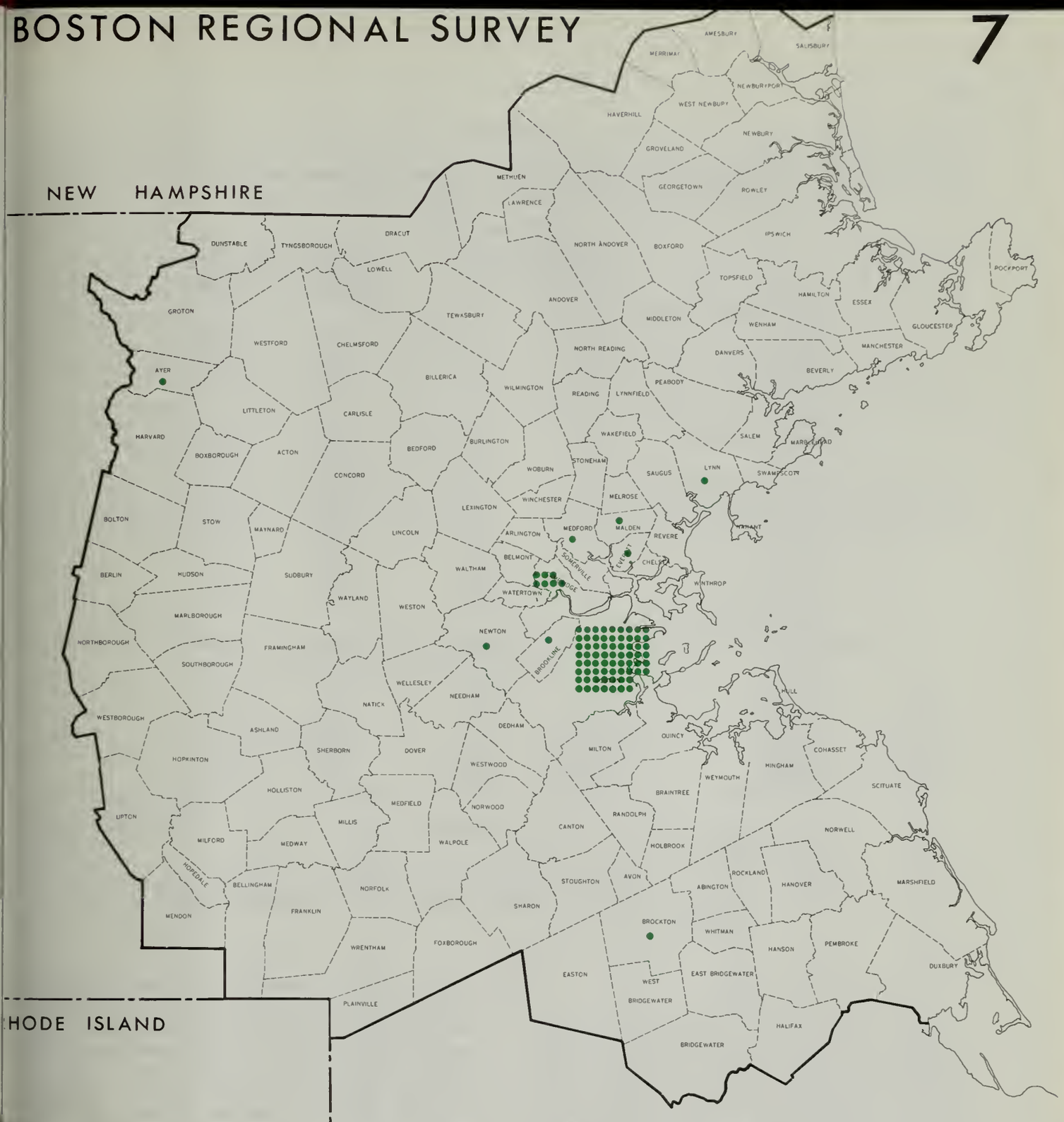
Negroes represent about 90% of the region's non-whites. Virtually all Negroes in the region live in the cities of Boston and Cambridge. In most of the region's suburban and outlying communities, the non-white population is numbered in the hundreds, if indeed there are more than a handful in residence. Apart from Brockton, there are few non-whites even in outlying urban centers.

In the case of the Negro population generally, low incomes reinforce social and racial factors to limit residential diffusion. Negroes are almost exclusively central city residents. Added to this combination of central city location and low incomes is a family pattern where the presence of two or more wage earners in one family is more common than is the case in the white population. Because of these factors a higher proportion of the Negro population tends to use mass transportation as compared to the white population.

Although Negroes are still a minor fraction of the population in the Boston area, their numbers have increased rapidly. In the 1950-1960 decade, the non-white population, expanded more than five times faster than the white population, and should this trend continue, non-whites in the region may exceed 150,000 in 1970. However, this would still represent only about 4% of the total 1970 population. This particular trend may prove to have special significance for future levels of mass transit patronage, in addition to its implications for social, economic, housing, and political patterns.

BOSTON REGIONAL SURVEY

7



NON-WHITE POPULATION, 1960

• EACH DOT REPRESENTS 1,000 PERSONS

SOURCE: U.S. CENSUS

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 = 2560 ACRES

SQUARE MILES

0 5 10 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION
BY THE PLANNING SERVICES GROUP CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

TABLE 11

PERCENTAGE OF NON-WHITE PERSONS IN THE BOSTON METROPOLITAN REGION AND OTHER SELECTED AREAS, 1950[1] and 1960

Area	Non-Whites: Per Cent of Total Population 1950	1960	Number of Non-whites 1960 (000's)	Per Cent Inerease 1950-1960
Boston Region SMSA's				
Boston	2.4%	3.4%	87.1	+ 56.3%
Brockton	0.9	1.4	2.1	+ 86.2
Lawrence-Haverhill	0.3	0.5	0.9	+125.8
Lowell	0.2	0.5	0.7	+119.4
Other Selected SMSA's				
Springfield-Holyoke	1.8%	3.2%	15.5	+107.2%
Hartford	4.0	5.6	29.3	+103.5
New York-New Jersey	8.1	11.0	1,624.0	+ 55.3
Philadelphia	13.2	15.7	681.3	+ 29.0
Cleveland	10.5	14.5	260.8	+ 69.2
Birmingham	37.3	34.6	219.8	+ 5.4
Atlanta	24.7	22.8	232.2	+ 40.0
San Francisco	9.9	12.5	346.7	+ 64.7
Los Angeles	6.7	8.8	595.5	+118.7
Selected Cities and Towns				
Boston	5.3%	9.8%	68.5	+ 60.2%
Brockton	1.0	1.7	1.2	+ 91.8
Brookline	na[2]	1.0	0.6	na[2]
Cambridge	4.7	6.3	6.8	+ 19.7
Chelsea	0.8	1.2	0.4	+ 21.9
Lawrence	0.3	0.5	0.4	+ 47.9
Wellesley	na[2]	0.4	0.1	na[2]
United States	10.5%	11.4%	20,491.4	+ 26.7%

1. 1950 pereentages are for Standard Metropolitan Areas.
2. Not Available.

Source: *U.S. Census of Population, 1960; General Social and Economic Characteristics* and *U.S. Census of Population, 1950;* Vol. II, *Characteristics of the Population.*

C. *Educational Characteristics*

In terms of levels of education attainment, the Boston region compares favorably with major eastern centers (See Table 12). Both the Boston and Brockton SMSA's rank higher than New York and Philadelphia which have been receiving areas for large numbers of poorly educated recent immigrants. In Massachusetts, as a whole, the proportion of students going on to some form of higher education has steadily increased from a 1952 level of about 35% to a 1961 level of approximately 50%.[5]

Dropout rates in the Boston region, judging from the percentage of 14-17 year old youths attending school, seem to be relatively moderate and in median school years completed, the Boston area ranks with the leaders. In the Boston SMSA, over half of the adult population had completed high school in 1960 Educational attainment patterns are less satisfactory in the Lowell and Lawrence-Haverhill areas. However, data from the U.S. Census indicate a major improvement in the Lawrence-Haverhill-Lowell patterns in the 1950-1960 decade.

Weaknesses in the region's education system have been the subject of considerable discussion in recent years. Problems needing correction include the poor physical quality of facilities, the low level of instruction prevailing in too many public primary and secondary schools, the increasing need for enlarged vocational training facilities, and growing requirements for public post-high school spaces. The latter is a special problem in an area strongly oriented toward private colleges and

5. Special Commission on Audit of State Needs, Commonwealth of Massachusetts, *Needs in Massachusetts Higher Education* (March, 1958). Also Massachusetts Department of Education, *Annual Reports.*

universities. (The percentage of private pupils, most of whom are enrolled in parochial institutions, is extremely high in some regional communities with the largest proportions found in the core and in the cities of Lawrence and Lowell. Brockton is particularly noticeable because of its low proportion (12.2%) of elementary school children enrolled in private schools.)

A particularly serious problem regarding education is the difference in standards in certain suburbs and in central cities. Public schools in some suburbs, particularly those to the west of Boston, provide educational facilities and teaching quality reputedly up to levels in good private institutions, while many central city schools are located in obsolete buildings, are poorly equipped and have found it difficult to develop and maintain a first rate staff. Lower educational standards and facilities in the central city areas seem to be due in part to weaker motivations among parents and students and to municipal fiscal stresses, as well as to entrenched factors within the systems. For these reasons the differences in educational characteristics between the core cities and suburbs seem to be self-reinforcing; many professional and business families will not settle in central city locations, and many of those who do live in cities enroll their children in private schools.[6]

While many of the comments regarding public schools are applicable to most metropolitan areas, the Boston region possesses a unique distinction in its world-renowned universities and colleges. The presence of these institutions has important implications for the region's population pattern. Students represent a large component of the population in Boston and Cambridge. It is estimated that most of the 80,000 to 100,000 college students in the region live in these two cities, probably representing about 10% of their population.

6. For discussions of national and regional educational problems see: Martin Mayer, *The Schools*, (Harper Bros. Inc., New York, 1961); James Bryant Conant, *Slums and Suburbs* (McGraw-Hill, Inc., New York, 1961); Special Commission on Audit of State Needs, Common- (March, 1958); and Ian Forman, *The Boston Globe series* (July, 1960).

TABLE 12

EDUCATIONAL CHARACTERISTICS FOR BOSTON METROPOLITAN REGION SMSA's AND OTHER SELECTED AREAS, 1950[1] and 1960

Area	Persons 14-17 Years Per Cent in School		Persons 25 Years Old and Over Per Cent who completed High School or more		Median School Years Completed		Children in Elementary School: Per Cent in Private School
	1950	1960	1950	1960	1950	1960	1960
Boston Region SMSA's							
Boston	88.9%	88.5%	47.6%	53.4%	11.9	12.1	22.8
Brockton	91.2	89.3	40.9	47.1	11.0	11.6	7.8
Lawrence-Haverhill	86.1	86.0	32.4	39.9	9.0	10.4	30.4
Lowell	83.6	83.3	33.9	39.7	9.8	10.6	29.8
Other Selected SMSA's							
New York-New Jersey	87.5%	87.6%	35.2%	41.2%	9.5	10.7	26.6
Chicago	89.2	87.6	36.3	42.1	9.9	10.9	32.4
Philadelphia	84.7	87.2	32.3	38.8	9.5	10.5	33.7
Selected Cities and Towns							
Boston		81.9%		44.6%		11.2	33.3
Brockton		88.9		43.9		11.2	12.2
Brookline		94.1		67.8		12.6	23.6
Chelsea		86.3		33.6		9.8	22.0
Haverhill		82.5		38.0		10.4	24.7
Lawrence		84.8		33.2		9.1	41.5
Lowell		80.5		35.6		9.9	44.6
Newton		93.8		71.7		12.7	19.4
Somerville		85.1		40.1		10.8	38.6
Wellesley		96.8		80.5		13.7	15.8

1. 1950 figures refer to Standard Metropolitan Area.

Source: *U.S. Census of Population, 1960; Advance Reports, General Social and Economic Characteristics,* and *U.S. Census of Population, 1950;* Vol. II, *Characteristics of the Population.*

D. *Occupational and Labor Force Patterns*

(Labor force and occupational characteristics of the Boston region appear, with certain important variations, to be in line with those in other large urban centers.) In 1960 the region's labor force was estimated at 1.4 million persons, two thirds of the state total. The Boston SMSA provides slightly more than three-fourths of the regional total and the second ranking area, the Merrimack Valley,[7] contains about one-tenth of the total. A major difference in occupational structure between the Boston SMSA and other major urban centers in the nation is Boston's strong emphasis on white collar occupations as compared to manufacturing employment. In 1960, less than 30% of the Boston SMSA's labor force was employed in manufacturing industries, while the Cleveland, Detroit and Pittsburgh SMSA's employed about 40% of their labor forces in manufacturing and the Chicago and Philadelphia areas about 35%.[8] However, the smaller urban areas of the Boston region, the Brockton, Lawrence-Haverhill and Lowell SMSA's have relatively high proportions of their labor forces engaged in manufacturing. When these are included together with the white collar oriented Boston SMSA, the regional average of labor force engaged in manufacturing rises to approximately one-third of the total, close to the Chicago and Philadelphia levels.

As Table 13 indicates, all four regional SMSA's increased their proportion of employment in white collar occupations while the proportion of employment in manufacturing declined in three of the four regional SMSA's. These trends are leading toward increasing similarity of employment structure among the region's four metropolitan areas.[9]

A number of implications for regional development are suggested by these trends. Among them is a growing need for improved and expanded technical training facilities to serve the larger proportion of the population that will be engaged in high-skill professional and tech-

7. Including the Lawrence-Haverhill and Lowell SMSA's.
8. *U. S. Census of Population*, 1960; *Advance Reports, General Social and Economic Characteristics.*
9. Everett J. Burtt, Jr., *Recent Changes in the Employment Structure of Greater Boston*, GBESC, Economic Base Report No. 3. (November, 1959).

TABLE 13

PER CENT OF EMPLOYED LABOR FORCE IN MANUFACTURING OR WHITE COLLAR INDUSTRIES IN BOSTON METROPOLITAN REGION SMSA's AND OTHER SELECTED AREAS, 1950[1] and 1960

	Employed Persons			
	Per Cent in Manufacturing Industries		Per Cent in White Collar Occupations[2]	
Area	1950	1960	1950	1960
Boston Region SMSA's				
Boston	28.6%	28.8%	48.3%	49.7%
Brockton	42.8	38.1	37.6	40.3
Lawrence-Haverhill	54.9	48.0	30.0	37.0
Lowell	45.0	42.0	32.6	36.1
Other Selected SMSA's				
New York-New Jersey	30.5%	25.8%	48.1%	49.5%
Chicago	37.5	34.2	44.8	45.5
Philadelphia	36.6	35.8	41.7	44.1
Selected Cities and Towns				
Boston	23.7%	24.4%	45.8%	43.8%
Brockton	43.0	37.9	38.4	40.6
Brookline	na[3]	15.4	na[3]	68.2
Chelsea	33.0	33.8	39.4	38.9
Haverhill	53.5	55.2	32.5	32.3
Lawrence	57.9	48.6	27.0	34.1
Lowell	46.5	43.7	33.2	34.1
Wellesley	na[3]	17.0	na[3]	70.8

1. 1950 Percentages are for Standard Metropolitan Areas.
2. Professional, Managerial (except farm), Clerical and Sales.
3. Not available.

Source: *U.S. Census of Population, 1960; Advance Reports, General Social and Economic Characteristics* and *U.S. Census of Population, 1950;* Vol. II, *Characteristics of the Population.*

TABLE 14

THE SIZE AND COMPOSITION OF THE LABOR FORCE IN BOSTON METROPOLITAN REGION SMSA's AND OTHER SELECTED AREAS, 1950[1] and 1960

Area	Total Labor Force: Number (in 000's) 1950	1960	Per Cent of Males Over 14 Years in Labor Force 1950	1960	Per Cent of Females Over 14 Years in Labor Force 1950	1960
Boston Region SMSA's						
Boston	980	1,078	76.1%	78.1%	32.4%	38.1%
Brockton	52	59	74.8	76.3	32.6	37.3
Lawrence-Haverhill	59	82	80.0	78.3	42.6	43.1
Lowell	54	63	74.2	77.3	34.4	39.3
Selected Cities and Towns						
Boston	337	312	75.2%	75.9%	35.1%	42.7%
Brockton	27	30	77.6	76.8	34.9	39.3
Chelsea	16	14	66.9	73.8	28.6	33.8
Lawrence	39	31	71.9	75.4	41.8	45.1
Newton	32	38	74.5	80.4	28.3	34.7

1. 1950 figures are for Standard Metropolitan Areas.

Source: *U.S. Census of Population, 1960; Advance Reports, General Social and Economic Characteristics* and *U.S. Census of Population, 1950;* Vol. II, *Characteristics of the Population.*

nical white collar occupations.[10] There is also a parallel danger that inadequately trained people may face increasing difficulty in finding and retaining jobs.

Approximately three-fourths of all men and a third of all women over the age of 14 in the region are in the labor force. (See Table 14.) A slight decrease in labor force participation rates by male workers can be anticipated by 1970, in line with projections for the nation as a whole. Table 14 indicates an increase in female labor force participation in the region from 1950 to 1960, a trend which is likely to continue. Changes in female labor force participation rates can have a significant influence on the growth and structure of regional employment, particularly in electronics and service industries which employ large numbers of female workers. Increasing female labor force participation has implications in terms of the potential for mass transit patronage. As the proportion of families with two members in the labor force increases, the patronage of mass transit rises, since many of these families do not have two automobiles. A rise in the number of two car families may slightly reduce the significance of this factor.

Within the region, the Lawrence SMSA has the greatest proportion of female labor force participation, followed by Lowell, Boston and Brockton. A large proportion of adult females have been employed in the textile industry which traditionally dominated the Lawrence and Lowell area economies. Despite the decline of the textile industry, the proportion of working women has remained high in these areas, since the incoming industries — electronics and ordnance — also utilize large numbers of women as production workers.

E. *Age Composition*

The two ends of the age spectrum — the young and the elderly — have increased more rapidly in the 1950-1960 decade than has the working age group thus increasing both school costs and care for the aged expenditures. Between 1950 and 1960 (See Table 15) the percentage of the Massachusetts population in the 18-64 age bracket, the broad group which provides over nine-tenths of the labor force, declined from slightly over 60% of the total population to 56%. While the state's under-18 year and over-65 year age group increased by a combined total of 400,000 persons, the 18-64 age group increased by less than 300,000. Moreover, the number of younger working age persons in the state — those in the 20-29 year age bracket — actually declined. A similar pattern has characterized the Boston region.[11]

Regional increases in the young and older segments of the population are due to high birth rates of the post-war years and to greater life expectancy of the older population. The young adult portion of the population, aged 20-29 in 1960, consists of persons born between

10. A good summary of current and future needs for skilled personnel in New England is contained in *New England Business Review;* Federal Reserve Bank of Boston (November, 1962).

11. Everett J. Burtt, Jr., *The Labor Force of Greater Boston,* GBESC, Economic Base Report No. 1 (June, 1959).

TABLE 15

AGE COMPOSITION IN BOSTON METROPOLITAN REGION SMSA's AND OTHER SELECTED AREAS, 1950 and 1960

Area	Per Cent of Total Population in Each Age Group						Per Cent Change in Each Age Group 1950-1960		
	Under 18		18-64		65 and Over				
	1950	1960	1950	1960	1950	1960	Under 18	18-64	65 and Over
Boston Region SMSA's									
Boston	27.0%	32.5%	63.2%	56.6%	9.7%	10.9%	+29.0%	— 3.8%	+20.0%
Brockton	28.3	35.6	59.9	53.2	11.7	11.2	+57.1	%10.8	+18.7
Lawrence-Haverhill	26.7	32.5	62.5	54.7	10.4	12.8	+25.1	— 9.9	+21.6
Lowell	29.2	36.4	60.3	53.5	10.5	10.2	+44.9	+ 3.0	+12.4
Other Selected SMSA's									
Springfield-Holyoke	26.3%	33.6%	64.4%	55.6%	9.3%	10.7%	+48.1%	0	+33.4%
Hartford	27.0	34.0	64.6	56.9	8.3	9.1	+62.7	+13.8	+39.5
New York	24.9	30.2	67.4	60.1	7.7	9.7	+35.5	0	+40.1
Philadelphia	27.4	33.5	64.5	57.3	8.1	9.1	+45.0	+ 5.1	+33.4
Selected Cities and Towns									
Boston	25.9%	28.7%	64.4%	59.0%	9.7%	12.3%	— 3.6%	—20.3%	+10.2%
Brookline	20.4	21.8	66.9	61.7	12.7	16.5	+ 1.0	—13.4	+21.4
Chelsea	27.9	30.5	63.8	57.5	8.3	12.0	— 5.1	—21.9	+25.6
Wellesley	25.8	32.7	65.1	57.8	9.1	9.5	+61.0	+12.7	+31.9
Lawrence	26.0	30.7	63.8	55.5	10.2	13.4	+ 4.1	—30.5	+19.0
Massachusetts	29.0	33.2	61.0	55.7	10.0	11.1	+25.7	+ 0.2	+21.8
United States[1]	34.8	39.7	59.5	54.0	5.7	6.3	+35.8	+ 8.0	+31.4

1. Age groups 0-19 and 20-64.

Source: *U.S. Census of Population, 1960, General Population Characteristics.*

1930 and 1940, the period of low birth rates during the depression. In the region, as in most areas, this age group is relatively small. This age group has also suffered from attrition in the Boston region through net out-migration. Between 1950 and 1960 about 35,000 more people aged 20-39 migrated from the region than entered it.

Changes in the age structure of the population, coupled with migration trends, were responsible for the fact that between 1950 and 1960 the labor force in the Boston SMSA increased by only about 5%[12] while the state's total labor force increased by almost 10%.

The disparity between rates of population growth and expansion of the labor force is expected to diminish in the decade 1960-1970. By 1970 the number of persons in the labor force is projected to increase by almost 10% while the region's population is projected to rise by only a slightly greater percentage.

Within the region the age structure of suburbs and central cities can be clearly differentiated. In the suburbs, high proportions of the population are found in the age groups under 18. This percentage exceeds 40% in some suburbs (e.g., Hull, Sharon, Randolph) while in some of the region's central cities (e.g., Boston and Lawrence) only about 30% of the population is under 18. In Brookline, a residential community adjacent to Boston, only 21% of the population is in this age bracket.

These age structure differences point to the primary reason for rapid tax increases in the suburbs, brought about by the need for school construction. They also suggest the reason for the existence of considerable amounts of surplus space in obsolescent central city public schools. A reversal of the downward trend of central city population not only depends on attracting unmarried students, working age people, and couples without children, but also on attracting families containing school age children. The latter, who have been strongly attracted to suburban areas can be persuaded to return in numbers to the central cities only if they provide first quality schools and other amenities.

The changes in regional age structure described above are fairly typical of those which have occurred in major eastern urban centers in the past two decades. However, there is one difference in comparative age distribution between core cities in the Boston region and such central cities as New York and Philadelphia. The percentage of young people is significantly higher in large eastern centers which have experienced massive in-migration of Puerto Ricans, Negroes and other groups in the past two decades than is the case in the slow-growing Boston region.

12. The SMSA boundary was used in both years to compute the 1950-1960 increase.

LAND USE

6. THE SPREAD OF URBAN DEVELOPMENT

In the three centuries since the initial Pilgrim settlement, urban development has spread over much of eastern Massachusetts. Much of this expansion occurred within the last seventy-five years, as can be seen in Figure 8, which compares the extent of urbanization in the Boston region in 1885 and in 1960.

The pattern of regional land use is directly affected by land configurations, water bodies, and other major physical features. The general geography of the region is, therefore, to be considered as a background to the subsequent examination of regional land use patterns.

A. *Physical Determinants of Land Use*

Four physiographic features of the region appear to have been particularly influential as determinants of the land use pattern:

a. The rivers of the region, especially the Charles and Mystic Rivers which enter the sea at Boston Harbor, together with the harbor itself, have exerted a major influence by making much of the region's core area readily accessible by water and by creating major obstacles to easy land movement between the core and other parts of the region.

b. The peninsular quality of the region's central area — downtown Boston — was a major asset in the earliest days of regional development because of its ready access from all sides by water, an important mode of transportation through the mid-nineteenth century. The fact that the water areas surrounding central Boston were shallow and readily filled, made possible a five times expansion of the land area originally available for development. Most of the port area, the Back Bay, and the Public Garden were filled in the nineteenth century, while substantial acreage in East Boston, including the site of Logan Airport, has been reclaimed in the past thirty years.[13] Much of this reclamation occurred in connection with one or another form of transportation. Extension of dock areas for shipping, and construction of railroad causeways across the shallow Back Bay area were especially important.

c. In the hinterland of the region and also in areas close to the core, major wetland areas have been temporary or permanent obstacles to development. The Saugus marshes to the north of Boston and the Neponset river mouth to the south are examples.

d. To a limited extent, the hills of the Boston region have presented an obstacle to the spread of urban development. This has been most noticeable to the south where the Blue Hills range lies between the Boston and Brockton metropolitan areas. Other rugged areas to the north of Boston, such as the Lynn Woods and Middlesex Fells were also obstacles to the continuous spread of development.

13. Greater Boston Development Committee, Inc., *Surging Cities*, Boston, 1948). See also Walter Muir Whitehill, *Boston: A Topographical History* (Harvard University Press, Cambridge, Massachusetts, 1959).

B. *Multiple Nuclei of Development*

Another important feature of urban development in the Boston region has been the fact that many independent cities and towns grew up in the hinterland. Some were originally farm villages or market centers while many others sprang up as centers of shoe or textile production or other types of manufacturing. Lawrence, Lowell, Haverhill, and Brockton are the largest instances of such independent urban centers, but the region contains dozens of other smaller urban concentrations dating back in some cases to pre-Revolutionary days.

An interesting result of the satellite pattern of urban development in the Boston region is the continued presence of sizeable areas of open land between urban centers. The availability of open areas close to densely settled urban concentrations is a major attraction that owes much to this aspect of regional history.

C. *Patterns of Growth*

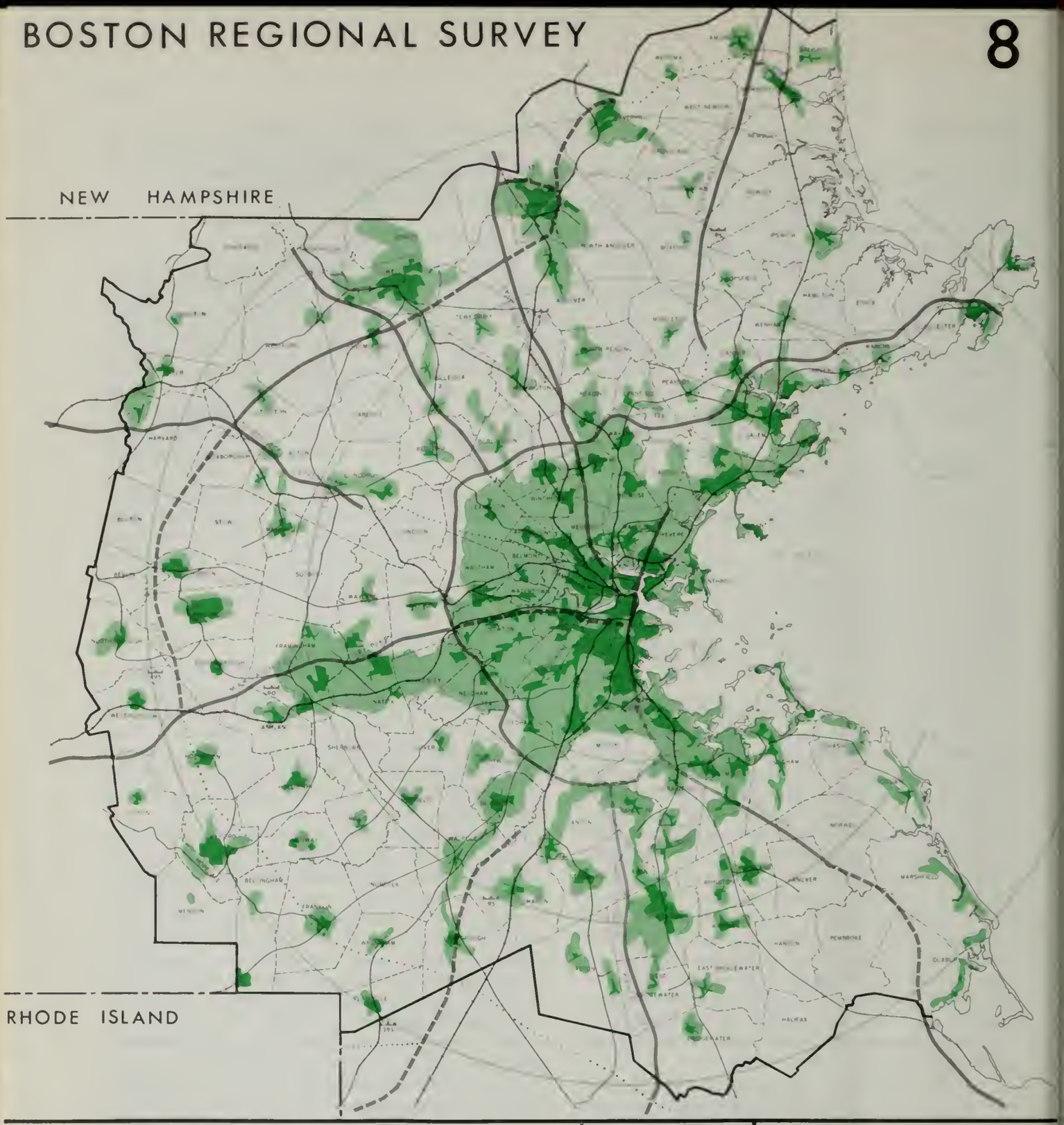
In the first two centuries of settlement, from 1620 to 1820, development was dense only in the immediate Boston area. Subsequently, urbanization spread outward, particularly to the north and along the northeast coast. Isolated, sizeable communities were also created in the Merrimack Valley to the northwest of Boston and at Brockton to the south. The railroad era stimulated major growth to the west.

Recent settlement has followed and accentuated the earlier pattern. The regional development pattern resembles a series of passageways, some broader than others, reaching out to merge with older independent settlements or flowing into open country. The urban extensions to the west and northwest are exceptionally broad. Narrower bands of settlement are apparent to the southwest, northwest, and southeast. However, some communities, and in fact some entire sub-areas, have been partially bypassed by the urban tide. This is particularly true of much of the area to the southwest of Boston as well as of individual communities close to the core. One key to continued low density development seems to be either isolation and/or difficult terrain, but equally important factors in retarding intensive development may be local decision, including large lot zoning and inadequate or non-existent public water or other municipal services.

Other phenomena are also apparent in the outward flow of urban development. First, there is a merging and overlapping of metropolitan areas as suburban growth proceeds outward from the cores of the Lawrence, Lowell, and Brockton areas — all less than 30 miles from the center of Boston. A second tendency is

BOSTON REGIONAL SURVEY

8



URBAN DEVELOPMENT, 1885 AND 1960

1885

1960

SOURCE USGS AND GBESC MAPS

GENERAL INFORMATION

EXPRESSWAYS
UNDER CONSTRUCTION
PROPOSED
MAJOR HIGHWAYS
SECONDARY HIGHWAYS
MAJOR RAILROADS
SECONDARY RAILROADS
RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 2560 ACRES SQUARE MILES

0 5 10 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP CONSULTANTS

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TABLE 16

INTENSITY OF LAND USE IN SUB-AREAS OF THE GBESC STUDY AREA,[1] 1960

Intensity	AREA				
	Core	Inner Sub-urbs	Outer Sub-urbs	Outer Cities	Total Area
Per Cent of total land developed	91%	54%	19%	47%	30%
Developed acres per 1,000 population	51	146	278	78	130
Persons per acre of residential land	35	11	6	20	13

1. The GBESC study area as defined in the Land Use survey is slightly smaller (by about 220 square miles) than the Boston Metropolitan Region. (See Figure 10.) The GBESC area contains 2,000 square miles compared to 2,220 square miles in the Boston Metropolitan Region.

Source: GBESC, *Greater Boston Land Use in 1960.* Land Use Report No. 1, (May, 1961).

the super-imposition of suburban subdivisions on earlier mill community and rural town patterns.

Figure 9 illustrates an important aspect of the pattern of urban growth in the Boston region. This map shows the proportion of developable land that has been utilized for urban purposes in each community of the region. It reinforces the visual impression of compactness and radial growth illustrated by Figure 8.

Another measure of the same phenomenon is contained in Table 16, which indicates the intensity of urban development in the region. (The core, inner suburbs, outer suburbs, and outer cities cited in Table 16 refer to areas delineated on Figure 10 in the next section.) The core is virtually all developed, but nearly half of the land in the inner suburbs — generally speaking, the communities along Route 128 — remains open, and only a small proportion of the land in the outer suburbs has thus far been preempted for urban use. In this respect the four "outer cities" of Brockton, Haverhill, Lawrence, and Lowell resemble the pattern of the inner suburbs more than that of the core.

D. *Transportation Factors*

The locations of major transportation routes and terminal points, and the different characteristics of water, rail, and vehicular travel technologies, have had a major influence on the urban development pattern.

a. *Water Transportation*

The many streams and harbors of the region made possible the early development of coastal settlements linked to one another by water. Salem, Marblehead, and Gloucester are instances of such communities. The fact that the region's streams do not generally penetrate deeply into the interior tended to limit the influence of water transportation on development to the shoreline and to areas near river mouths. Watertown and Cambridgeport on the Charles River are instances of the few "inland" communities near Boston that were at one time accessible for commercial shipping.

In the nineteenth century, efforts were made to improve the interior waterways of the region. The most ambitious were the Middlesex Canal from the Mystic River to Lowell and the attempt to construct a Boston to Albany canal.

b. *Rail Transportation*

In very large measure, the present basic urban pattern of the Boston region was created by the railroad. The introduction and spread of the railroad (and its outgrowth, the inter-urban street railway,) coincided with the acceleration of urban expansion and the rapid rise of the textile and shoe industries in the region in the period following the Civil War. Urban settlements throughout the region grew up along the railroad and major paths of regional development followed major rail routes. The land use pattern of downtown Boston was strongly influenced by the efforts of various railroads to establish routes and terminals in the water surrounded peninsula of Boston.

Railroads may still be a significant element in shaping the region's land use pattern if one or more of the proposed conversion of rail routes to rapid transit service is approved. Such action would probably result in an increase in density of development along the route, especially near transit stations.

c. *Motor Vehicle Transportation*

Before the invention of the internal combustion engine, horse-drawn vehicles constituted an important element in the regional transportation system. Since the early years of the twentieth century, the self-powered motor vehicle has opened up possibilities of travel in a multitude of directions, and has had a great influence on urban development and land use since World War I.

The astonishing multiplication of automobiles has been a major cause of the spread of development throughout previously open areas of the region in the now familiar suburban pattern. Vast numbers of motor vehicles have congested urban centers, especially downtown Boston, and have called forth an increasing effort to cope with their parking and movement requirements. The regional system of expressways is the most notable element that has been created to meet the increasing needs of vehicular travel. Although many components of this system are as yet incomplete, the ring-and-radial network of limited-access roads has already had a major influence on the regional land use pattern and it appears likely to be the single most important transportation factor in determining the future regional land use pattern.

7. PRINCIPAL FEATURES OF THE LAND USE PATTERN

Among the salient features of the regional land use pattern are the following:

A. *Open Character of the Region*

Although the Boston region is one of the longest inhabited and most densely settled parts of the nation, two-thirds of the region (a million acres out of a million and a half) consists of open land, most of it wooded. Only about a fifth of the total land is residential, mostly single-family residences. Other land uses represent even less significant fractions of the regional pattern. Manufacturing and commercial uses — the chief components of the economic base — comprise only 7.5% of all regional land.

B. *Dominance of the Core*

Despite trends toward decentralization, the core area still contains the largest concentrations of most urban land uses. The dominance is marked in multi-family residential, industrial, and commercial uses. The core, which contains only about 6% of the region's total land area, contains one-third of its industrial and commercial land and two-thirds of its multi-family acreage. There is a heavy concentration of industrial land uses in and around Boston harbor and a concentration of commercial uses in downtown Boston. Because of the multitude of individual communities in the region which are almost exclusively residential in nature, there are entire zones in which most of the labor force must commute ten, twenty, or more miles to work.

C. *Spread of Residential Uses*

In each of the sub-areas outside the core, residential uses account for about three-fifths of the total developed urban land. Aside from industrial concentrations in a few mill towns, the predominant land use in suburban areas is single-family residence. There are, however, significant differences between the inner and outer suburbs. Most of the developable land areas inside Route 128 has been filled in by residential subdivisions and other urban development. In contrast, urban settlement in the suburban and outlying communities beyond Route 128 has clung closely to major highway radials, leaving substantial amounts of vacant land between the major expressways.

TABLE 17

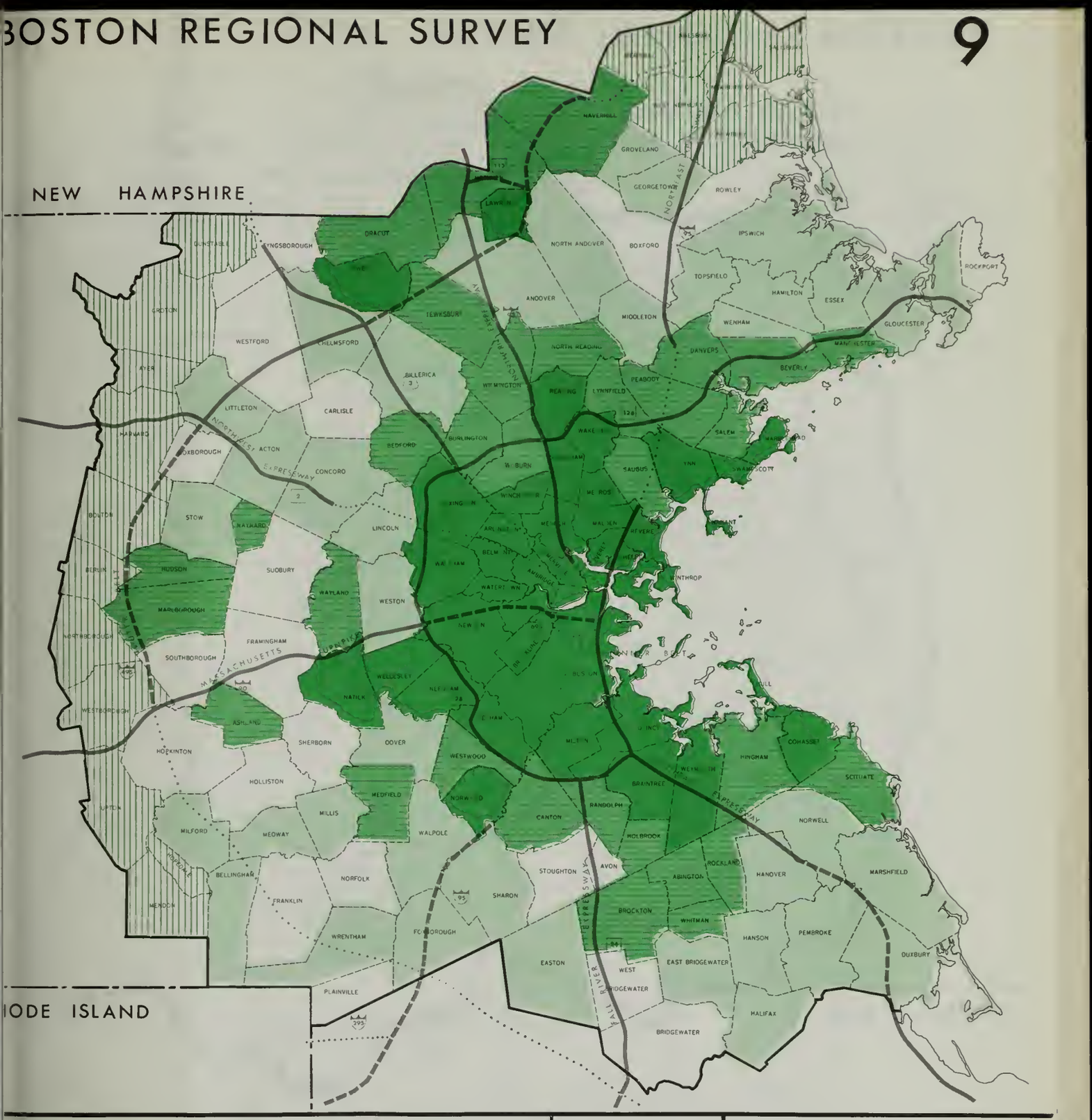
LAND USE IN SUB-AEAS OF THE GBESC STUDY AREA, 1960

	Core		Inner Suburbs		Outer Suburbs		Outer Cities		Total Area	
Land Use	Acres (000's)	Per cent	Acres (000's)	Per cent	Acres (000's)	Per cent	Acres (000's)	Per cent	Acres (000's)	Per cent
Developed Land										
Residential	41.7	56.7%	83.4	60.9%	130.9	59.1%	14.3	69.9%	270.3	59.5%
Commercial	4.8	6.6	4.5	3.3	5.2	2.4	0.8	3.6	15.3	3.4
Industrial	6.1	8.2	5.6	4.1	5.7	2.6	1.3	6.0	18.7	4.1
Public Utilities	2.9	4.0	6.1	4.4	8.7	3.9	1.2	5.4	18.9	4.2
Institutions	8.6	11.7	14.4	10.6	35.5	16.0	1.7	7.9	60.3	13.3
Recreation	9.5	12.8	22.8	16.7	35.5	16.0	2.7	12.2	70.4	15.5
Sub-Total, Developed Land	73.6	100.0	136.8	100.0	221.5	100.0	22.0	100.0	453.9	100.0
Undeveloped Land										
Land Management	0.7		1.8		19.3		0.1		21.9	
Vacant and Agricultural	6.5		116.0		931.4		25.2		1,079.2	
Total Land	80.8		254.6		1,172.2		47.3		1,555.0	

Source: GBESC, *Greater Boston Land Use in 1960*. Land Use Report No. 1, (May, 1961).

BOSTON REGIONAL SURVEY

9



PER CENT OF USABLE LAND DEVELOPED, 1960

- UNDER 13%
- 13 - 24.5%
- 25 - 54.5%
- OVER 55%
- NO DATA

SOURCE: GBESC LAND USE STUDY

GENERAL INFORMATION

- EXPRESSWAYS
- UNDER CONSTRUCTION
- PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

NORTH

2560 ACRES = 1 SQUARE MILES

0 5 10 MILES

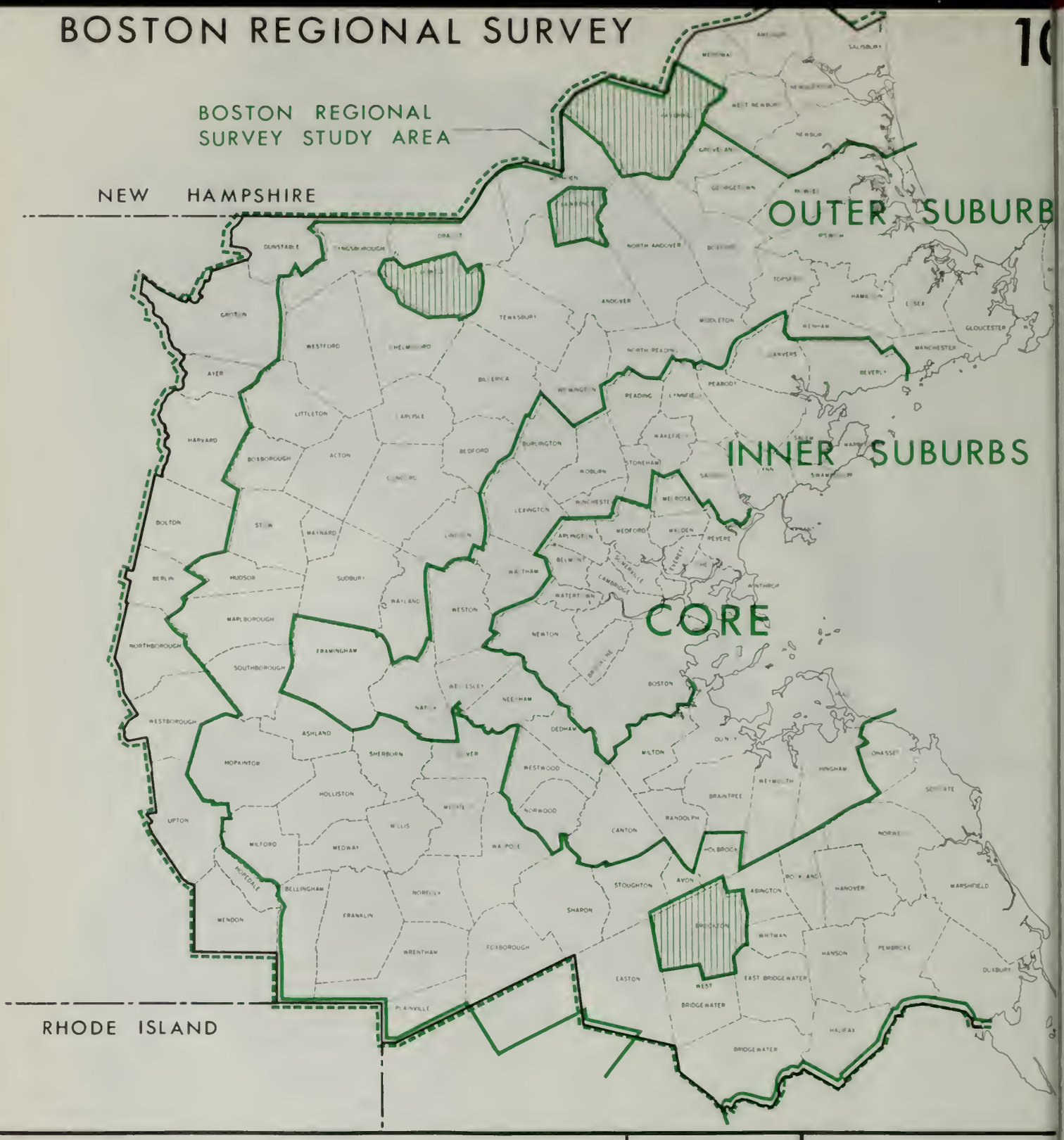
SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

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BOSTON REGIONAL SURVEY



GBESC LAND USE STUDY ZONES

OUTER CITIES

SOURCE: GBESC LAND USE STUDY

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

◆ SYMBOL APPEARS ONLY WHERE LISTED TOWNS SHOWN ON MAP

NORTH

SQUARE MILE

0 5 10

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D. *Open Nature of Outer Cities*

The four outer cities (Brockton, Lawrence, Lowell and Haverhill) which together contain only 3% of the region's land area, contain a fifth of the region's developed land. While Lawrence is almost completely developed, the other outer cities contain a good deal of open land. In fact, more open land exists in the outer cities than is currently used for urban purposes.

8. CHARACTERISTICS OF MAJOR LAND USE CATEGORIES

Some of the most important characteristics of major urban land use categories include the following:

A. *Residential Land Use*

The region's core is the dominant site for multi-family housing. The pattern of residential density by communities in the Boston region is shown in Figure 11, which indicates the decrease in residential density as distance from the core or major sub-centers increases. This is a common feature of metropolitan development in the nation.

Figure 11 does not reveal the great number of residential density variations which exist among neighboring communities and even between neighborhoods within a single community. For example, there is still considerable open territory (in the form of large estates) in such long-settled, built-up core communities as Brookline; there is multi-family housing in suburban communities like Norwood and Newton; and there are dense clusters of small house lots adjoining country estates in the outer suburbs.

B. *Residential Construction Patterns*

Table 18 presents the number and per cent distribution of dwelling unit permits issued in the region in the years 1950 and 1960. In both years residential building in the Boston region was devoted primarily to the construction of single family dwellings: four-fifths of all permits issued in 1950 and 1960 were for single family

TABLE 18

DISTRIBUTION OF BUILDING PERMITS[1] ISSUED IN THE BOSTON METROPOLITAN REGION IN 1950 and 1960

Type of Dwelling	Number of Permits 1950	Number of Permits 1960	Per cent of Regional Total 1950	Per cent of Regional Total 1960
Single Family Dwellings				
Cities				
Core[2]	2,090	944	12.9%	6.3%
Outer Cities[3]	471	1,245	2.9	8.3
Suburbs				
Boston SMSA suburbs	9,269	6,866	57.1	45.6
Three other SMSA suburbs	1,060	1,604	6.5	10.6
Suburbs outside SMSA's	308	1,566	1.9	10.4
Total Single Family	13,198	12,225	81.3	81.2
Multi-Family Dwellings[4]				
Cities				
Core[2]	1,673	1,535	10.3%	10.2%
Outer Cities[3]	400	27	2.5	0.2
Suburbs				
Boston SMSA suburbs	938	1,148	5.8	7.6
Three other SMSA suburbs	—	58	—	0.4
Suburbs outside SMSA's	24	61	0.1	0.4
Total Multi-Family	3,035	2,829	18.7	18.8
TOTAL DWELLINGS	16,233	15,054	100.0%	100.0%

1. The dwelling unit permit data were compiled from actual counts for each town in the region. They are single year counts and do not represent an average, thus, the possible range of variation in any one year is considerable. However, observation of permits for other years indicates that the difference between 1950 and 1960 are representative of actual trends, but because of business recessions and other causes, there are considerable fluctuations from year to year. The attrition rate (permits issued but not acted upon) represents about 2% of the total.
2. The core consists of 15 inner cities as defined by GBESC (See Figure 10).
3. The four cities of Brockton, Haverhill, Lawrence and Lowell.
4. The multi-family category includes two-family structures.

Source: Massachusetts Department of Labor and Industries, *Summary of Building Permit Activity, 1950* and *1960.*

houses. The liberalization of mortgage credit terms and the substantial reduction of required down-payments in the purchase of private homes (through the FHA insurance and the GI mortgage programs) have been a substantial factor in the spread of single-family middle-income suburban development.

The Boston Standard Metropolitan Statistical Area[14] leads in total dwelling unit construction, the building permit data in Table 18 indicate an important change in distribution of dwelling construction. Single-family construction in the core fell by over 50% and in Boston SMSA suburbs by about 20%. An increase in single family construction in the outer cities category was primarily due to a sharp gain in the city of Brockton, which accounted for more than one-half of all of the building permits issued in 1960 in the outer cities. Areas outside the region's SMSA's experienced the greatest increase in single family building, with their share increasing from less than 2% to 10% of all regional residential construction.

Multi-family dwelling construction is a field in which the Boston region has followed rather than led other parts of the nation. Between 1950 and 1960, regional construction of multi-family units averaged about 3,000 per year, accounting for only 20% of the total number of dwelling units built in the decade. In contrast, it is estimated that apartment buildings represented 45-50% of units constructed during 1950-1960 in the New York-New Jersey metropolitan area, 20-25% in the Chicago area, and 35-40% in the San Francisco area.[15] The strong trend toward large scale building of cooperative apartments and other types of middle income, multi-family dwellings apparent in other large metropolitan centers has not until quite recently been reflected in building activity in the Boston area; much of the apartment house construction which has occurred in the region has been of either luxury unit or public housing character. There appears to be a large unsatisfied market for multi-family units ranging between $35 and $55 per room; luxury units range between $75 or $100 per room or even higher while public housing is in the $15-$25 per room category. The increased emphasis on apartment house construction is apparent in recent construction data. Of the 16,000 permits issued in 1961 for construction of dwelling units in the region, 35% were for multi-family units.

C. *The Need for Residential Renewal*

The continuing decline of population in the central areas of the region in core communities and in outlying urban centers is closely correlated with the decay and deterioration of housing and neighborhoods in these older, densely built-up communities. The competition offered by newer, single-family housing and attractive subdivisions in suburban locations has been a factor in stimulating relocation from city to suburbs. The answer to the question as to whether or not this dispersion process can be slowed — much less reversed — depends substantially on the success of efforts to renew the residential neighborhoods of the region's central cities.

The physical condition of housing in the Boston region appears to be generally in line with conditions in other large eastern urban centers. In the region as a whole, about one out of every eight dwelling units is substandard according to the U.S. Census. As can be seen in Table 19, housing conditions in the Boston and Brockton SMSA's are somewhat better than in either

14. The Boston Metropolitan Region contains all or most of four SMSA's: Boston, Brockton, Lawrence-Haverhill, and Lowell.
15. Urban Land Institute, *New Approaches to Residential Land Development*, Technical Bulletin No. 4 (January, 1961).

TABLE 19

SUBSTANDARD HOUSING IN THE BOSTON METROPOLITAN REGION AND SELECTED AREAS, 1960

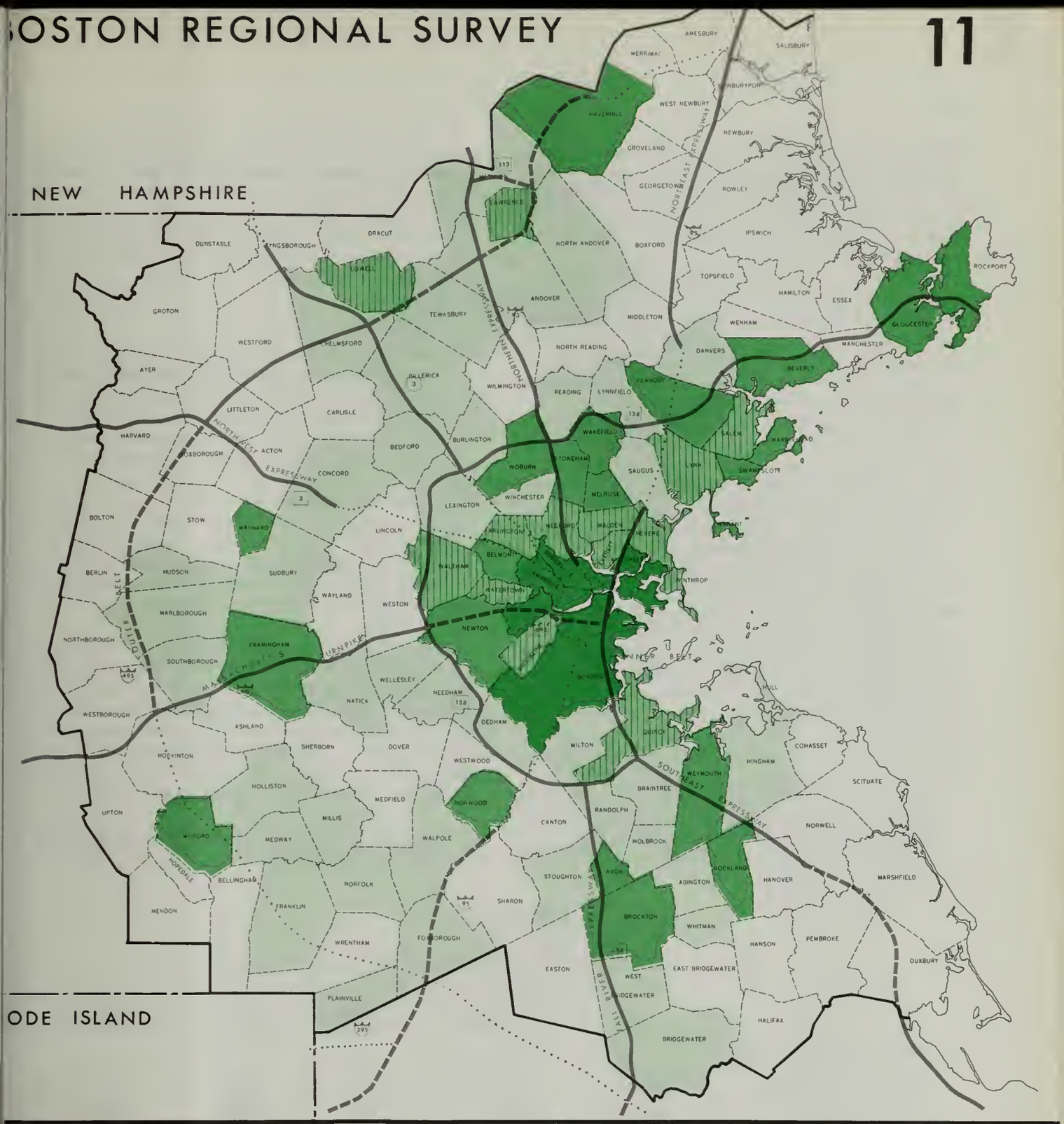
Area	Total Number of Dwelling Units (000's)	Per Cent[1] Sub-standard	Per Cent Dilapidated
Boston Region SMSA's			
Boston	814.1	12.3%	2.3%
Brockton	46.0	11.9	2.4
Lawrence-Haverhill	58.3	16.9	2.9
Lowell	48.9	14.4	2.9
Other Selected SMSA's			
Providence-Pawtucket	269.6	12.3%	2.5%
Springfield-Holyoke	151.6	13.2	2.1
Hartford	164.0	16.4	2.0
Selected Cities			
Boston	238.8	19.2%	3.9%
Brockton	24.1	12.3	2.0
Lawrence	24.4	19.8	3.3
Lowell	30.0	14.8	2.5
Brookline	19.6	5.1	0.6
Cambridge	35.3	13.7	3.0
Newton	26.1	4.7	0.8
Somerville	29.2	14.0	1.6
Waltham	15.0	7.2	0.5
Providence	73.0	16.3	2.9
Springfield	58.7	19.0	3.1
Holyoke	18.6	9.4	0.4
Hartford	57.6	14.0	3.0
New York	2,758.1	15.5	3.1
Philadelphia	649.0	12.7	2.1

1. Substandard includes both dilapidated and deteriorating buildings as defined by the U.S. Bureau of the Census.

Source: *U.S. Census of Housing, Advance Reports, 1960.*

BOSTON REGIONAL SURVEY

11



RESIDENTIAL DENSITY, 1960

- UNDER 5 PERSONS PER RESIDENTIAL ACRE
- 6 - 10
- 11 - 20
- 21 - 50
- OVER 50

SOURCE: GBESC LAND USE STUDY

GENERAL INFORMATION

- EXPRESSWAYS
- UNDER CONSTRUCTION
- PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 = 2560 ACRES
SQUARE MILES

0 5 10 MILES

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the Lawrence-Haverhill or Lowell metropolitan areas. Substandard dwellings include units that are dilapidated as well as those that were classified as deteriorating by the Census Bureau.[16] In the region as a whole, dilapidated units represent only about 2.5% of the total number of residences.

However, the situation with respect to substandard housing is far more serious in the core portions of the region where as much as one-sixth of all housing may be substandard. As can be seen in Table 19, the percentage of substandard housing in Boston is estimated at 20% — about the same level as in other core communities such as Revere and Chelsea.

Hopes for solutions to core area housing problems lie in the success of the urban renewal efforts that have been stimulated by the Federal Housing Act of 1949, 1954, and 1961. Especially important is the concept of rehabilitation first introduced in the 1954 act and extended in concept in subsequent federal legislation.

Large scale slum clearance and redevelopment is too expensive for general application throughout large urban areas. Based on New York City experience, it has been estimated that "a square mile of rotted urban streets and structures" may run to $160 million for site acquisition alone.[17] While the cost of acquiring a square mile of slums in the Boston region is much lower, neither the municipalities nor the Commonwealth — not even the federal government — appear to be financially capable of supporting a massive program composed solely of land clearance and redevelopment. For this reason, renovation and rehabilitation, combined with limited amounts of clearance, appear to hold greater promise. Future land use patterns, population density and distribution, levels of mass transit patronage and other key development trends in the core and the region's central cities may hinge on the degree to which close-in housing areas can be revitalized.

16. The Census defined a dwelling unit as dilapidated when it had serious deficiencies, was rundown or neglected, or was of inadequate original construction, so that it did not provide adequate original shelter or protection against the elements or endangered the safety of the occupants. A deteriorating dwelling unit was defined as one that is not dilapidated but lacked certain basic facilities such as plumbing.
17. Raymond Vernon, "The Economics and Finances of the Large Metropolis," *Daedalus: The Future Metropolis* (Winter, 1961).

D. *Commercial Land Use*

Commercial land in the region is divided fairly evenly between the core area and the inner and outer suburbs. Downtown Boston,[18] the specialized center of financial, service, and other region-serving commercial activities, contains almost 3% of the region's commercial land area and devotes over a quarter of all its land area to commercial uses. The ratio of commercial land to total developed land decreases with distance from the core, while the amount of commercial land per capita increases in the suburbs. Surveys conducted by the Boston City Planning Board[19] estimate that there is 9.5 million square feet of floor space in Downtown Boston, about one-third of the total retail floor space in the core.

Table 20 indicates: (1) floor space in planned centers accounts for only a tenth of total retail floor space in the Boston region; (2) almost half of the floor space in planned centers is located in the inner suburbs, and (3) despite trends toward suburbanization, the core still contains the bulk of the region's retail floor space. There appears to be an average of about 4.5 square feet of retail floor space per capita in regional

18. Downtown Boston has been defined by GBESC as the area bounded by Massachusetts Avenue, Fort Point Channel, and the Charles River.
19. Boston City Planning Board. *A General Plan for the Central Business District* (Boston: City of Boston Printing Department, 1960).

TABLE 20

RETAIL FLOOR SPACE IN THE BOSTON REGION,[1] 1962

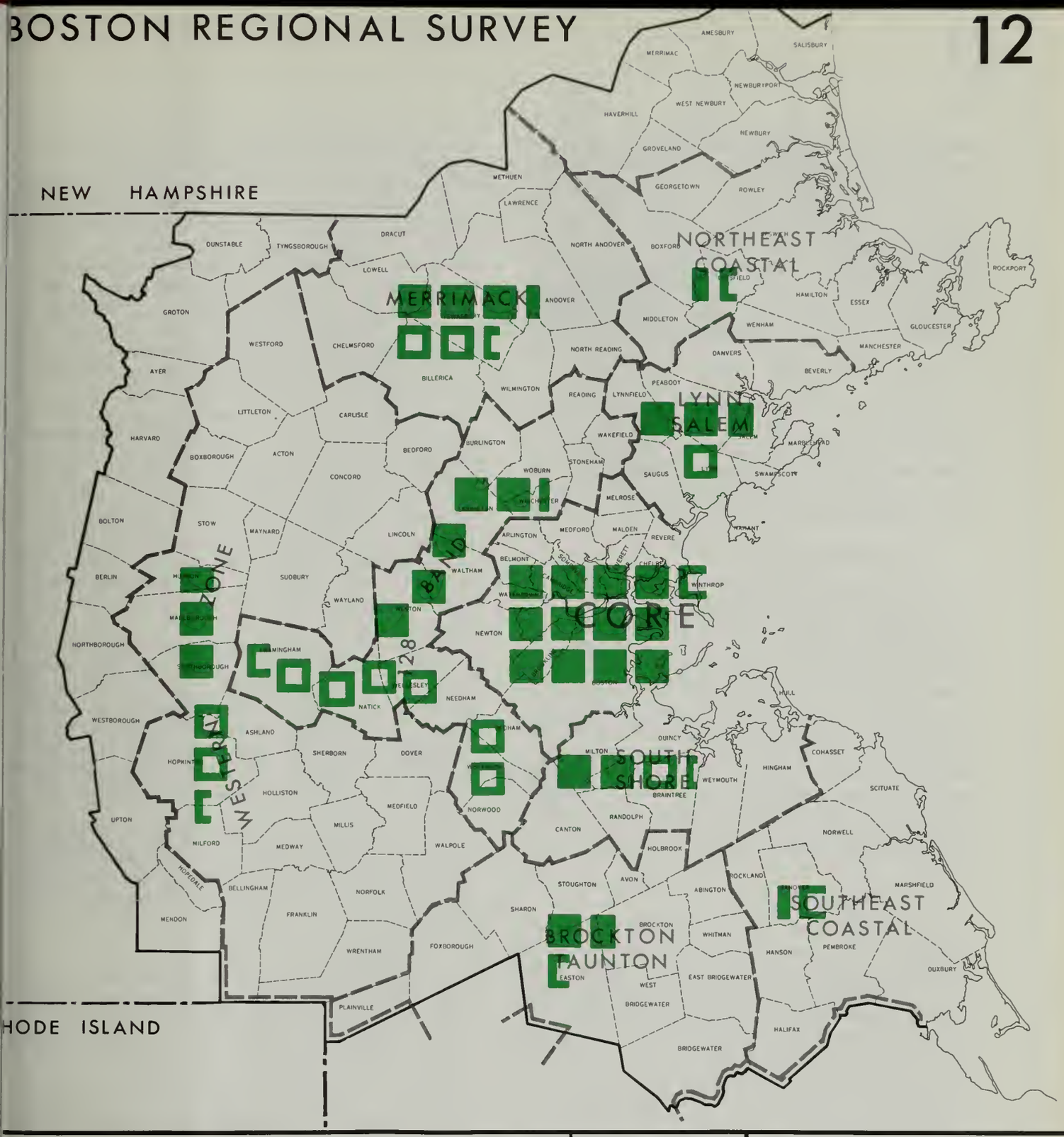
(in thousands of square feet)

	Core	Inner Suburbs	Outer Suburbs	Total Square Feet	Per Cent of Total
Conventional Shopping Districts					
Region-serving	9,000 sq. ft.	2,000 sq. ft.	300 sq. ft.	11,300	26.4%
Community and Local	17,000	7,000	3,000	27,000	62.9
Total	26,000	9,000	3,300	38,300	89.3%
Planned Shopping Centers					
Region-serving	—	1,000	—	1,000	2.3%
Community and Local	2,000	1,000	600	3,600	8.4
Total	2,000	2,000	600	4,600	10.7%
TOTAL SQUARE FEET	28,000	11,000	3,900	42,900	—
Per Cent of Total	65.3	25.6	9.1	—	100.0

1. The sub-areas, Core and Inner Suburbs, correspond to the areas as defined on Figure 10. The outer suburbs, however, include only 59 of the 100 outer suburbs represented in Figure 10.

Source: Estimated by the consultant from data compiled by: The Boston Globe, *Shopping Centers and Shopping Districts in the Boston Market* (April, 1962).

BOSTON REGIONAL SURVEY



INDUSTRIAL LAND

500 ACRES OF INDUSTRIAL LAND, 1960

500 ACRES OF LAND TO BE USED FOR INDUSTRY, 1960-80

SOURCE: GBESC INDUSTRIAL LAND STUDY

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION
BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

shopping facilities, as compared to 11 or 12 square feet per capita in community and local oriented facilities.

In the Boston region planned shopping centers have been almost exclusively confined to retail services. Entertainment facilities are minimal and civic features (such as auditoria or public offices) as well as multi-family housing, have not been developed in this area. Thus, the region's shopping centers have not developed a range of activities comparable to the wide variety associated with Central Business Districts.

E. *Industrial Land Use*

The pattern of regional industrial land use was the subject of a recent report prepared for the Greater Boston Economic Study Committee.[20] This report analyzed recent and projected industrial employment patterns and related these patterns to present and projected industrial land use.

a. *The Existing Pattern*

At present, only 15,300 acres — a very small fraction of the Greater Boston's total area — is actually used for industrial purposes, and almost 40% of this industrial land is located in the core. As of 1960, over three and a half times as much open land had been zoned for industry as was in use for industrial purposes. In contrast to the way in which the core dominates the industrial use pattern, the bulk of the industrially zoned land is in the suburban and outlying portions of Greater Boston. Industrial parks or planned districts are increasingly important in the region's industrial landscape. It has been estimated that they account for well over half of all land brought into industrial use between 1950 and 1961.

b. *The Projected Pattern*

Between 1960 and 1980, it is estimated that over 8,000 additional acres of industrial land will be required to accommodate the increase in manufacturing and wholesaling activity projected for Greater Boston, a land use gain of more than 50% over 1960. The projected twenty-year increase reflects two major factors: a projected gain of nearly 170,000 manufacturing jobs and the tendency of moden industry to use an inincreasingly greater amount of land per worker.

If the major influences on location continue to work through 1980 in about the same way as they have in the recent past, the report suggests that 40% of all new industrial land will be located in the Route 128 area.[21] The Merrimack Valley and the Western sub-regions will each account for just under 15% of the net gain, the Lynn-Salem and South Shore areas will receive 6.5% and 7.0% respectively, and the core and the Southeast Coastal regions will each capture about 5%. Very little new industrial land is expected to come into use in the Brockton-Taunton and Northeast Coastal areas.

Among other findings, it is significant that the region's growing industrial categories — electrical machinery and ordnance production — tend to be land-intensive, requiring little ground space per worker. The region contains very little extensive industry while both of its large, declining categories — textiles and leather — tend to be moderately extensive users of land. Thus, despite the increasing trend of modern industry to spread out in one story suburban buildings, the region's changing industrial structure will tend to reduce the amounts of land that will be required for future needs.

One of the region's most distinctive land use features is the almost continuous chain of modern industrial parks and industrial plants on or adjacent to Route 128 (the circumferential expressway which arcs through the region approximately 10 to 12 miles out from the center of Boston). This particular type of development — virtually constituting a permanent industrial exposition — has attracted nationwide attention and engendered numerous attempts at emulation. The industrial land study presents information on 60 industrial parks in the Greater Boston area.

As might be expected, about 40% of the region's industrial park acreage is found in the communities along Route 128. The largest amount of new industrial acreage created in industrial parks occurred in the period 1956-1959. Considerable recent slowing of new industrial park development in the Route 128 area was apparent in the 1960-61 period, but major activity has been taking place in the Western and South Shore subregions.

The average size of industrial parks is 120 acres, with only four parks over 400 acres and 37 under 100 acres. Total acreage in industrial parks as of 1961 was 7,200, of which two-thirds was still open and available for use.

F. *Recreational Land Use*

Of the total of 70,000 acres of recreation land in the study area, 25,000 acres was in local recreation use, and 33,000 in regional parks and open space.

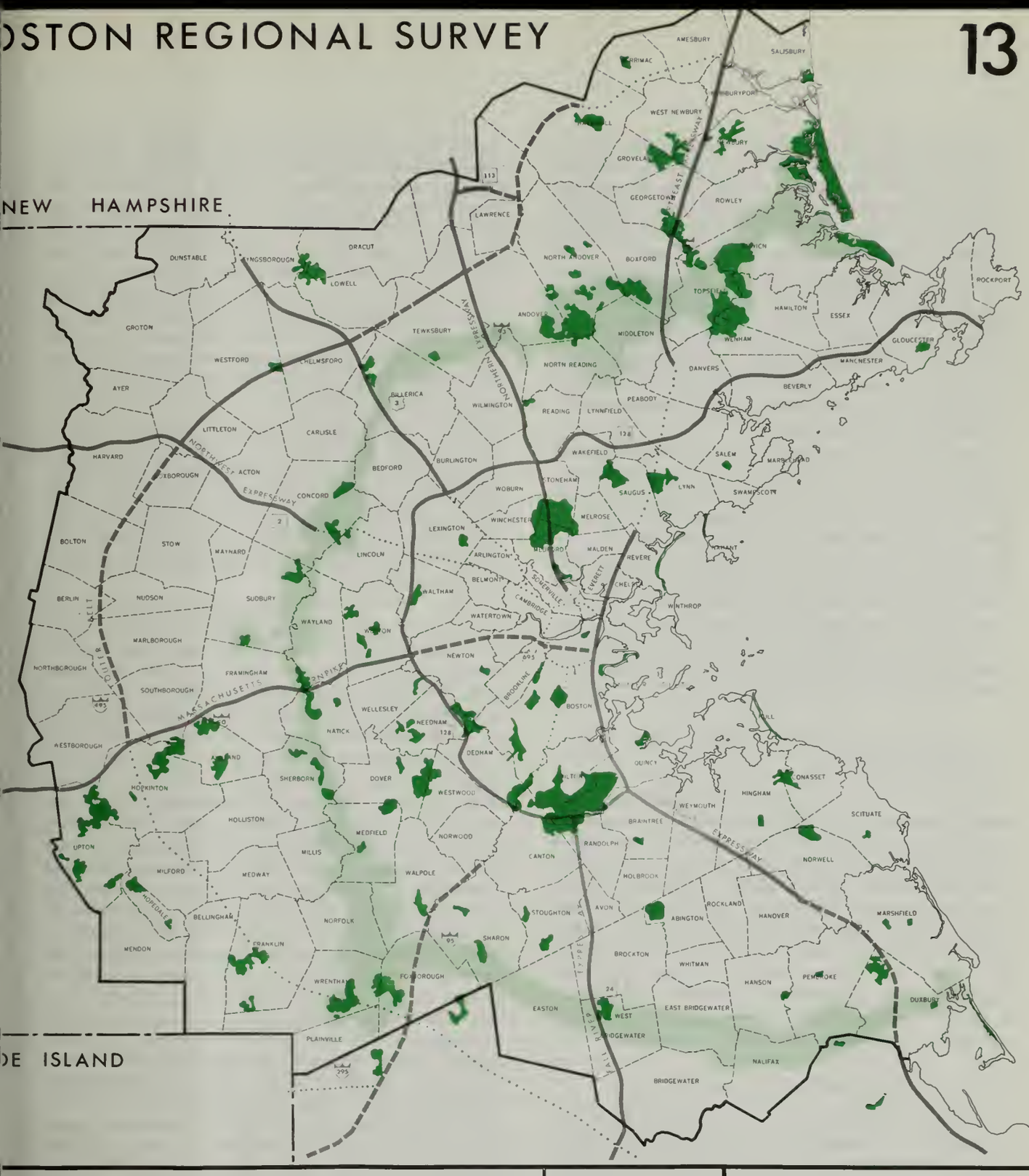
On a regional basis, taking all types of recreation land — private as well as public — into account, there appears to be an abundance of land available for recreation purposes. However, recreation land in many cases is poorly distributed, is inaccessible for wide public use, or is inadequately developed.

Over and above the problem implied by the present relationship of recreation space to present population numbers and distribution, there is the equally important question of serving the future needs of a substantially larger, more affluent, and probably more decentralized population. Whatever the nature of the existing gap between available recreation space and the region's present population, the unfilled need is likely to widen rather than diminish in the future. According to one

20. Melvin R. Levin and David A. Grossman, *Industrial Land Needs Through 1980*, GBESC Land Use Report No. 2 (May, 1962).
21. See Figure 12 for sub-region boundaries.

OSTON REGIONAL SURVEY

13



MAJOR PUBLIC OPEN AREAS

EXISTING REGIONAL PARKS AND FORESTS

PROPOSED BAY CIRCUIT

SOURCE: GBESC LAND USE SURVEY

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
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SQUARE MILES

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D FOR THE MASS TRANSPORTATION COMMISSION

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estimate, to meet the requirements forecast for the latter part of the 1970's the capacity of accommodations for public outdoor recreation in state parks, forests, and reservations would have to be increased by a factor of four between 1957 and 1977, in addition to the need for substantial increase in public ocean beaches.[22]

The real recreation area problem confronting the Boston Metropolitan Region lies on the horizon, within thirty to forty years much of the region will be fully developed, primarily in the form of a dispersed pattern of single family detached dwellings. At the same time the population may expand by as much as a million and a half persons, generating an enormous increase in the demand for recreation space.

Local and region-wide surveys suggest that additional park and beach acreage and other types of recreation facilities should be created at once. In this connection, the Metropolitan District Commission, local planning boards, and recreation commissions for various communities in the region have consistently recommended increased public acquisition of land for reservation or park purposes. An interesting suggestion to meet further needs for regional open space, first made some years ago, is the proposed creation of a green belt about 30 miles from the center of the region, in the general area between Route 128 and Route 495.[23]

9. FUTURE PATTERNS OF REGIONAL DEVELOPMENT

Until the current program of the MTC began, no major effort had been made to formulate a comprehensive development plan to direct the future growth of the Boston Metropolitan Region, although many of the 144 separate municipalities within the region have prepared such plans for their own jurisdictions. The integrated transportation and planning study of the Boston region recently undertaken by the MTC will be the first such effort on a regional basis. It will also include the assembly of far more information on land use and transportation conditions and patterns than has ever been available for the Boston region.

A. *The Consumption of Regional Land*

A major consideration in land use trends is the rate of conversion of open land into urban uses. This extension of development into rural areas has involved substantial increases in land for industrial and commercial purposes, but residential land uses are by far the major consumer of open land.

The core, with very little open land, is of secondary importance in shaping future regional land use development patterns. Redevelopment rather than new development is of critical importance in the core. As a rule redevelopment introduces only limited changes in the regional land use picture, although it may have substantial effects on economic, social, and transportation patterns. Redevelopment is more likely to change the quality and intensity of land use. The Charles River Park urban renewal area for example has altered a high density, low-rent residential area to a slightly lower density, high-rent residential area. Because of the high price of in-town land, relatively small acreages are involved in redevelopment projects. For example, the entire Government Center Project in downtown Boston involves less than 100 acres.

The key to estimating regional development trends in land use is the rate of open land utilization and the nature of development in suburban and outlying areas. Unfortunately, reliable statistical benchmarks for earlier periods are lacking. This has made it necessary to develop broad — and admittedly crude —estimates based on construction, employment, population changes and zoning patterns.

One of the most significant trends in the region has been a thinning out of core population density with an accompanying increase in suburban residential densities. This process uses land lavishly: on a per capita basis urban development in the inner suburbs uses three times as much land as in the core area and in the outer suburbs it normally utilizes almost six times as much land.

It is probable that the new dwelling units constructed in suburban and outlying communities of the Boston region between 1950 and 1960 required 40,000 to 50,000 acres — allowing for streets, schools, and ancillary public and private facilities.[24] If land used for commercial, industrial, institutional, and highway purposes is included, a total of perhaps 50,000 to 60,000 acres of open land may have been converted to urban use during the 1950-1960 decade. If the 1940-1960 population trends continue, the Boston Metropolitan Region will experience a population increase of about 1.5 million persons in the 1960-2000 period. On the assumption that 1950-1960 land consumption patterns will continue throughout the 40-year period, a minimum of about 50,000 acres of open land may be converted to urban use per decade. At this pace, by the year 2000 about 200,000 acres of open land will be developed out of the total of 800,000 acres of open land in the GBESC study area that were tentatively classified as suitable for development as of 1960. Naturally, this projection would have to be revised if future population trends vary from the 1940-1960 pattern or if housing tastes shift toward proportionately greater amounts of multi-family construction.

22. Edwards, Kelcey and Beck, *An Inventory and Plan for Development of the Natural Resources of the Commonwealth, Part II: Public Outdoor Recreation*, Prepared for the Massachusetts Department of Natural Resources (Boston, June, 1957).
23. Edwards, Kelcey and Beck, *Op. cit.*
24. This estimate is based on GBESC findings that the number of acres of residential land per 1,000 persons averaged 90 in the inner suburbs and 165 in the outer suburbs. An average of 120 acres per 1,000 population and about 3.5 persons per new dwelling unit would result in an estimated 42,000 acres that would be utilized for residential purposes for 100,000 new dwellings.

Based on this rate of land consumption, the region as a whole is not likely to experience a serious land shortage for any of its needs in the foreseeable future, but by the end of the 1970's open sites may be scarce in the inner suburbs and the outer cities. In contrast, the outer suburbs, which possess enormous quantities of open land, will not run out of readily developable sites until well into the next century.

To a considerable degree, the region's vacant and rural acreage can be considered a land reserve which can be drawn against when necessary. By far the greater part of this open land appears readily developable, since an estimated 80% of the open land has less than a 15% slope and is well drained (according to GBESC analysis). There is a marked tendency for developers to direct their attention to open rural land — which is usually relatively cheap — rather than to confine themselves to land zoned for urban development. This is one of the reasons for the growing emphasis in many areas on conservation and land acquisition programs aimed at reserving open land for public use.

B. *The Role of Agriculture*

Farming plays a rapidly diminishing role in the region land use pattern. In 1960 less than a sixth of the region (fewer than 200,000 acres) was used for farming, as compared to a quarter of regional acreage ten years earlier. Under the pressures of urbanization and the increasing competition in major segments of the region's agriculture the amount of land devoted to agriculture in the region has decreased at the rate of about 25% per decade since 1940. Assisted by importation of low cost feed grains, a high degree of skill or capital inputs from non-farm sources, some urban farmers have continued to flourish, but these are in the minority. Abandonment of farming well in advance of actual alternative use and the return of cultivated land to untended forest is one of the major trends throughout much of the urbanized eastern seaboard.[25]

C. *The Effect of Zoning Patterns*

To the extent that present zoning represents a commitment to a particular land use pattern, future urban redevelopment in the Boston region may assume much the same form as in 1960. Figure 14 compares the proportions of open, zoned land in the region with land devoted to major urban uses and reveals that the combined zoning decisions of the 144 cities and towns seems to point to essentially a continuation of the 1960 pattern of land use. Only with respect to multi-family use does the present zoning depart from the present land use pattern. Proportionately, only an eighth as much open land is zoned for multi-family use as is currently utilized for this purpose.

25. A penetrating discussion of trends in agricultural and forest land use is found in, Jean Gottmann, *Megalopolis* (The Twentieth Century Fund, New York, 1961).

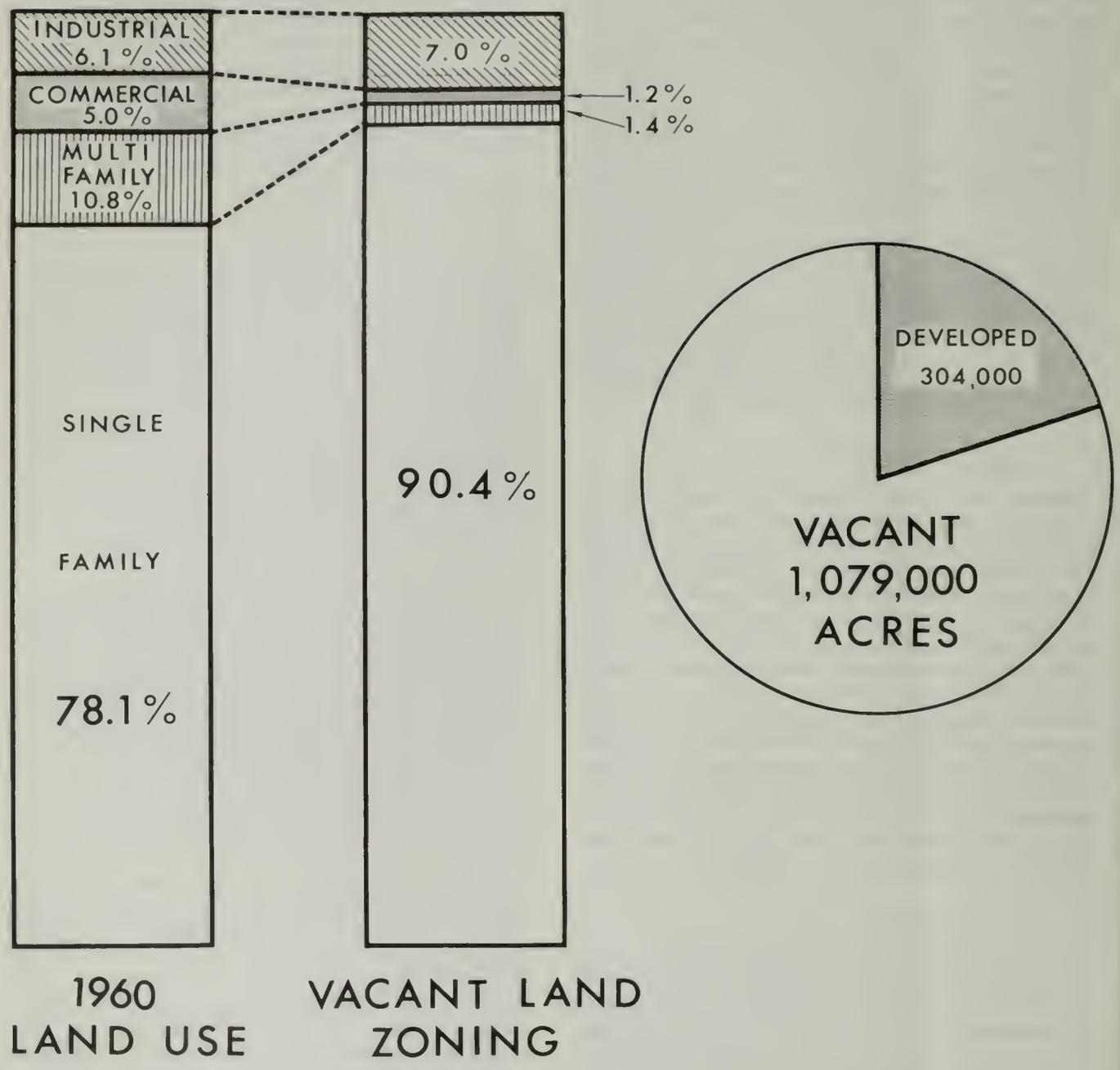
Experience abundantly proves that zoning maps are not always an accurate presentation of a town's actual future land use. Greater Boston municipalities have tended to zone large areas of undeveloped land for two principal uses: single family and industrial. A potential under-zoning for multi-family housing (and possibly over-zoning for single family use) in the present pattern may be indicated by the fact that whereas in 1960 approximately 15 acres were used for single family dwellings for every acre used for multi-family units, there are 60 areas zoned for single-family use for every acre zoned for multi-family dwelling.

Current zoning, even making allowances for site unsuitability, would theoretically permit a very great increase in all types of development. For example, if all zoned land were fully used, available sites could support twice the 1960 population and four times 1960 industrial employment. It must be recognized, however, that the region-wide abundance of open land zoned for various purposes conceals a number of localized shortages. Aside from the probable insufficiency of multi-family zoning in suburban areas, suitably zoned land is in short supply in a number of communities. In some suburban towns large lot zoning is the chief reason for the shortage of attractively priced residential land while in the core communities land speculation and problems of land assembly into usable parcels may be responsible.

In the GBESC study area, 180,000 acres of the approximately 700,000 acres of open land zoned for single family residential use and considered readily developable, was zoned for lots of one acre or larger as of 1960. Zoning for lots of one acre or more accounts for over a third of the buildable residential land in the outer suburbs and a quarter of the remaining readily developable land zoned for single family use in the inner suburbs. The distribution of large lot acreage is shown in Figure 15. Even in the site-poor core, a significant percentage of the remaining open acreage is zoned for large lots.

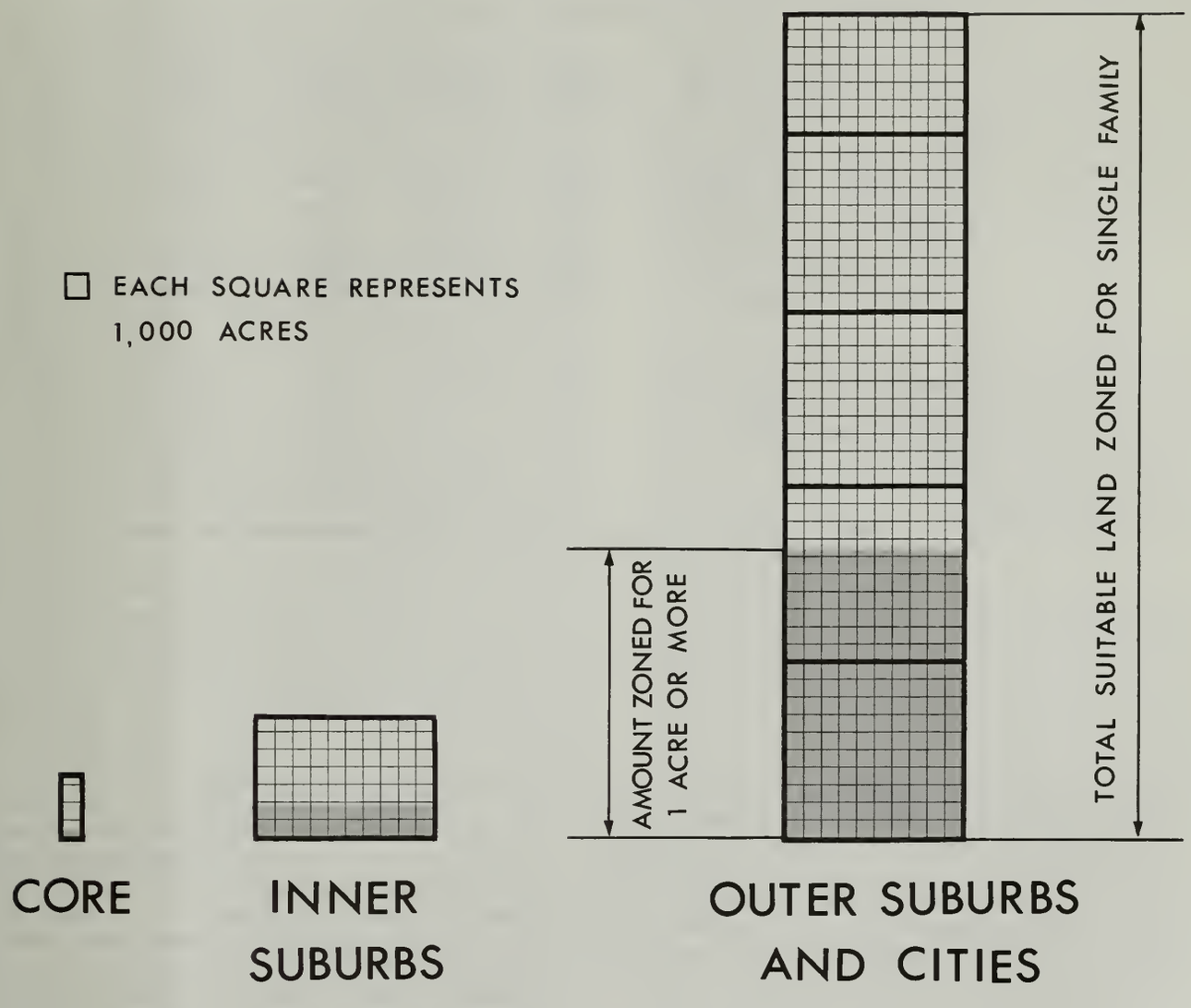
Little of the acreage in the region, even in the outer suburbs, is zoned for lots much larger than one acre. This, however, is subject to change. One of the major trends in regional land development is the increase in minimum acreage requirements for single family dwellings as more and more communities seek to escape an influx of low cost houses which could result in higher taxes for the present residents. A continuation of the long term trend toward large lot sizes can be anticipated as more and more communities attempt to zone out large scale, low-cost housing.

All indications are that housing patterns in the next twenty years will not differ greatly from those of the 1950-1960 period. The bulk of the region's new housing will continue to be single family, detached units, although some increase in the proportion of multi-family dwellings appears probable. New residential construction is not likely to create an insuperable drain on the



LAND USE AND ZONING 1960, GBESC AREA

SOURCE: GBESC LAND USE STUDY



LARGE LOT ZONING OF SUITABLE LAND, 1960

SOURCE: GBESC LAND USE STUDY

TABLE 21

ZONING OF OPEN LAND IN SUB-AREAS OF THE GBESC STUDY AREA, 1960

(in Thousands of Acres)

Land in Acres	Core	Inner Suburbs	Outer Suburbs	Outer Cities	Total Area
Zoning					
Single-family	3.4	97.3	853.1	21.4	975.3
Multi-family	1.2	00.7	13.0	0.3	15.2
Commercial	0.3	2.3	9.3	1.2	13.1
Industrial	1.7	15.7	55.9	2.4	75.6
Total Open Land	6.5	116.0	931.4	25.2	1,079.2
Per Cent of Total Land	8.1%	45.6%	79.5%	53.2%	69.4%
Character of Land					
Swampy	1.3	26.2	189.1	2.6	221.2
Slope of 15% or More	0.3	10.7	42.8	0.5	56.1
Suitable for Development	4.9	79.1	699.5	22.1	801.8

Source: GBESC, *Land Use in Greater Boston in 1960,* Land Use Report No. 1 (May, 1961).

region's open land supply, but land shortages in close-in suburbs — created partly by large lot zoning — will probably lead to additional emphasis on developing tracts in outer suburban communities. The 1960-1970 and 1970-1980 decades therefore may see extremely rapid housing expansion in the outer suburbs coupled with a deceleration of growth in the inner suburbs and a relatively modest amount of residential construction in the core.

It also appears unlikely that any shortage of industrial and commercial land will develop in the foreseeable future — always excepting prime sites in the most desirable locations. The GBESC industrial land study found only one sub-region of Greater Boston in which the amount of open, suitable land now zoned for industry was only equal to the industrial land expected to be needed in the next two decades. This exception was the Route 128 band. In all other sub-regions there was a sizeable surplus of open, zoned land — ranging up to 26 acres available to one of projected need in the Brockton-Taunton area. Even the core apparently contains sufficient open industrial land to support considerable growth in industrial use.

D. *Future Patterns of Growth*

Barring major action to alter the pattern of regional growth, the future directions of development of the Boston Metropolitan Region appear likely tc resemble those of the recent past. These broad directions are not readily subject to short term manipulation, since they are the result both of long-standing trends and economic pressures. Actions by local government — such as are represented in the adoption of local zoning by-laws — appear more likely to encourage and accommodate than oppose these directions. This does not mean that the pattern of urban development in the region cannot be altered. Actions that are well within the power of local and state government can directly influence the pace and pattern of urban development. These actions include zoning, the provision (or refusal to provide) basic urban services (such as water, sewerage, drainage, or schools) and the amounts and types of transportation facilities that are constructed.

CHAPTER TWO — ECONOMIC BASE

1. HISTORICAL DEVELOPMENT

For almost three centuries the Boston region's economy has alternated between decades of survival and considerable growth. In the process, the region has overcome serious locational handicaps, scanty natural resources and continued out-migration of many of its productive residents. There were few basic natural resources in the region for economic expansion other than an excellent port and a moderate amount of water power on the fringes of the region. Boston's geographic location including its overland isolation from the Midwest and Canada was and still is a serious handicap. To compensate for these disadvantages, business and financial leadership within the community has consistently demonstrated an ability to adapt successfully to changing conditions.

The region's present economy represents a distinct break with relatively stagnant patterns of the past century, when the economy was largely based on low wage industries. The region now has a diversified economic base underwritten by great financial strength and stimulated by pre-eminence in the research and development sectors of international growth industries. As its economy has increasingly shifted to a reliance on intellectual capital, some traditional assets have become less significant. For example, there is no large unskilled labor pool which was one of its strengths in the 19th century and which now can be found in New York, Chicago and in the South. Instead, the economy runs primarily on a cerebral fuel, on the products of its major universities and on the skills and intelligence of a corps of financial, professional and technical personnel ranking with the best in the nation.

Despite the risks involved in its present heavy dependence on federal military and research expenditures, the region is probably on firmer ground than it has been in many years. With one of the nation's largest concentrations of scientifically oriented growth industries and a strong financial and insurance function, the economy of the region promises even greater expansion. While Boston's traditional economic assets — its port, its access to water power, and its pool of low wage labor — faced strong competition from better situated areas, the area's competitive abilities in sciences and finance are not adversely affected by its geographic location or its lack of natural resources. In fact the rapid technical obsolescence created by new discoveries is probably one of the most important factors in safeguarding the region from a future drastic upheaval in employment patterns of the kind which struck its textile and shoe industries. There is a fair degree of assurance that large numbers of jobs for skilled workers as well as for scientists and engineers will emerge from the region's laboratories. The region's research and development and its custom-production electronic industries are not as susceptible to automation as are stable industries in which long production runs are feasible.

This is not to say that serious problems need not be faced. Unemployment in some parts of the region is far too high, average factory wages are below the national average, further problems are foreseeable in the remaining segments of the region's textile and shoe industries, and competition for science-based installations is becoming increasingly keen.

A. *The Growth of Commerce*

The port of Boston was the fulcrum of the regional economy for over a century. From the early part of the 18th century until the late 19th century, Boston was one of the nation's three leading commercial centers, vying with New York and Philadelphia. Boston specialized in buying, selling and processing goods produced in other areas. Prior to the Revolutionary War the area was closely involved in trade between England and the West Indies.

Victory in the War for Independence at first proved a disaster for the Boston economy, mainly as a result of exclusion from the British trading system. Britain effectively reduced trade between the United States and the West Indies, limited imports of naval stores, and eliminated the slave traffic to the West Indies. During the protracted conflict between the British and French empires (1793-1815), trading between Boston and Europe was sharply reduced further by blockade, privateers, impressment, embargos, and other restrictions. However, Boston merchants not only survived but prospered by opening up new fields of endeavor. These included speculative but highly lucrative privateering ventures, commerce with Russia and China, and the Columbia River fur trade. Of more long range importance, a by-product of the disruption of European commerce was the establishment of infant manufacturing industries with the proceeds derived from sale of blockaded vessels. Following the 1815 Treaty of Ghent which brought the second war with England to a close, increasing British competition triggered the opening salvo in the New England textile industry's century and a half struggle for tariff protection from lower priced foreign imports.

B. *The Decline of Commerce and Growth of Industry*

Between 1825 and 1850 New York began to pull ahead of Boston. The completion of the Erie Canal and other waterways enabled New York to tap the rich, growing Midwestern market far more effectively than Boston. Later, the advent of the railroads intensified

New York's lead over Boston. Not until after the Civil War was there a direct rail connection between Boston and Chicago and by that time Boston had been permanently reduced to a secondary status with respect to New York. Throughout this period the familiar back haul problem — the lack of outgoing cargo — bedeviled the area's economy.

Boston's success with commercial activities over the years has provided one essential ingredient for economic growth: capital. With fortunes accumulated in commerce, particularly in the China trade, Boston capitalists financed manufacturers within the region and elsewhere in New England. Boston capital was also a key factor in railroad development throughout the nation. In turn, profits from these ventures further enlarged the pool of investment capital.

Manufacturing industries were established on the fringes of the Boston region in such places as Lynn and Salem (shoes and leather) and in Lowell (cotton textiles) and Lawrence (wool textiles) where ample process water and water power of the Merrimack River was available. In the case of Fall River and New Bedford, where Boston capital also found a promising field, tidewater access to cotton shipments was the decisive factor, and the large mills were able to develop and monopolize a productive and generally docile labor market.

Until about 1850 Boston itself, and in fact most of the present core area, contained relatively few industries other than handicrafts. Population growth was slow and out-migration rates were high. Immigration was largely confined to newcomers drawn from the depressed agricultural areas of New England.

After 1845 a huge influx of immigrants from famine-stricken Ireland changed the situation radically. The ready-made apparel industry in which Boston wages averaged only half of those paid in New York City was only one type of manufacturing to exploit this vast pool of low cost labor. Sugar and oil refining, primary and fabricated metals, production of musical instruments, machinery, shipbuilding and brewing, glass, and shoe and leather manufacturers also forged ahead, their growth stimulated by labor costs so low as to more than compensate for locational handicaps.

The middle of the nineteenth century was an era of spectacular growth for Boston. Within little more than two decades (1845-1865) Boston became the nation's fourth ranking manufacturing city.[1] The number of industrial employees in the city doubled between 1845 and 1855, and doubled again between 1855 and 1865.

The succeeding three or four decades were in many ways a repetition of the 1850's and 1860's, although the sources of immigration changed. French Canadians penetrated the Merrimack Valley textile mills in large numbers, Italians entered the building trades and the shoe industry, and Jews from eastern Europe drifted into apparel manufacturing and retail trade.

C. *Decline of Soft Goods Domination and Growth of a Diversified Economy*

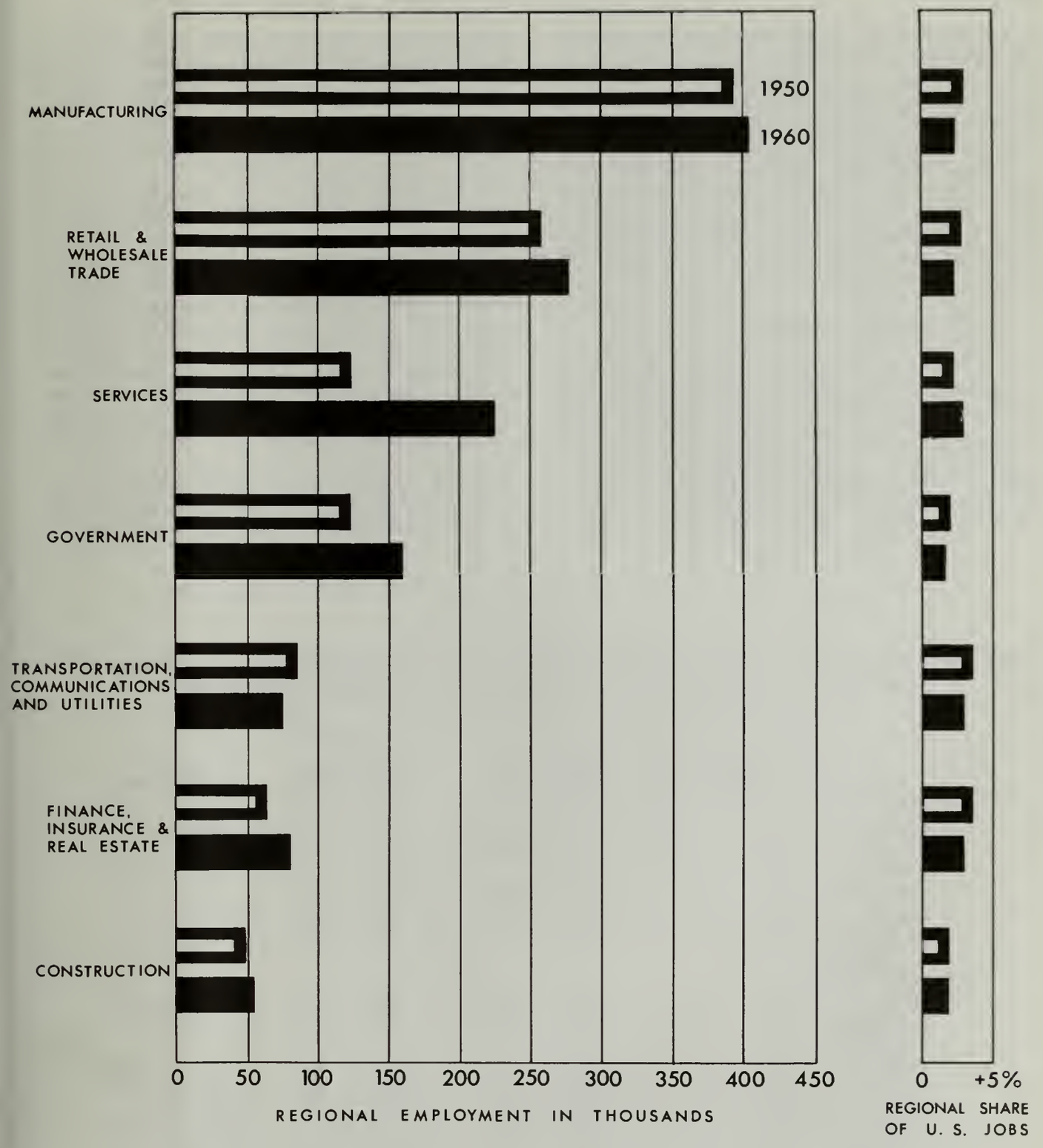
In the early 1900's Boston entered into another phase of development when growth in soft goods industries began to decelerate, particularly in leather goods and textiles. The actual decline in textiles did not set in until the early 1920's, but by 1910 it was clear to many observers that the region's textile industry and the industries related to textile production were due for trouble.[2] Although some observers continued to assert that the regional future of textile industry was still bright,[3] the balance had shifted decisively southward by the mid-1920's. However, the region remained heavily dependent on the textile industry until the end of World War II. Through the early 1940's the region relied on its decaying soft goods base and an industrial pattern more characteristic of the early stages of manufacturing development rather than of a dynamic, modern economy. Aside from their secular downward trend, the region's soft goods industries exhibited another unfortunate trait. As a result of changes in technology and its vulnerability to lower-wage Southern competition, nearly all of the region's employment in textiles has disappeared.

The region's industrial pattern did not change basically between 1850 and 1947. Textiles and textile machinery was still the region's leading industry in 1947 and leather production was still a major part of the post-war industrial scene.

During World War II the region's stagnant industrial base began to change, and the rate of change accelerated shortly after the war's end. Technological advances, closely associated with research at the area's major universities, resulted in a significant increase in electronics and instrument manufacturing. Growth in these industries gathered momentum through the early years of the cold war, the Korean War, and the space age. In the twelve years from 1947 to 1959 progress in technology and the impact of mammoth defense expenditures helped to create a powerful and rapid expansion in the region's electrical machinery and allied industries sufficient to compensate for a simultaneous attrition in soft goods employment.

By the early 1960's the weakened soft goods industries had diminished to the point where further job losses were a relatively minor factor in the employment picture. The textile and leather categories comprised only 15% of the region's total manufacturing jobs in 1959 as compared to 29% in 1947. Employment in government, retail and wholesale trade and business services expanded substantially.

1. Oscar Handlin, *Boston's Immigrants* (The Belknap Press of Harvard University, Cambridge, Massachusetts, 1959).
2. E. Alderfer, and H. E. Michl, *The Economics of American Industry* (McGraw Hill, New York, 1957).
3. George French, editor, *New England What it is and What It Should Be* (Boston Chamber of Commerce, 1911).



EMPLOYMENT BY MAJOR CATEGORIES BOSTON METROPOLITAN REGION 1950 - 1960

SOURCE: U. S. DEPT. OF LABOR, EMPLOYMENT AND EARNINGS

The Boston region has long shared with New England the reputation of conservatism and slow growth, yet in the past decade a change has occurred in this image. It is partly a consequence of the industrial growth along Route 128 and because the Boston area weathered the nation's four post war business recessions (1948-49, 1953-54, 1957-58, and 1960-62) in excellent style. Unfortunately, the same cannot be said of the three other metropolitan areas in the region; all are soft goods manufacturing centers which have been battered by cyclical downswings and subjected to long term erosion of their economic bases.

2. THE REGION IN PERSPECTIVE

It is useful to view regional economic patterns in the broad perspective of the nation's economy. In 1960 the national labor force consisted of 73 million persons. Of this total, 2.5 million were in the armed forces, almost 4 million were unemployed, and 5 million were farm workers. The remaining 60 million workers employed in non-agricultural industries include virtually all of the persons at work in large urban areas. However, information for over 5 million of the 60 million is not available because accurate, comparable data are not maintained for self-employed persons, for unpaid family workers, and for domestic workers in private households. The U.S. Bureau of Labor Statistics reported that covered non-agricultural employment in the nation in 1960 totalled 54.3 million.[4]

In the Boston region covered, non-agricultural employment in 1960 was 1.3 million — 2.3% of the national total.

Manufacturing industry is the largest segment of total non-agricultural employment in the nation, providing almost a third of all employment. Wholesale and retail trade combined rank second nationally with about a fifth of the total. Government and service categories each provide a seventh. Finance,[5] construction, transportation,[5] and mining are relatively less important factors. This national pattern generally holds true for the Boston region as well as for most other major urban

4. Covered employment refers to jobs included in unemployment compensation programs.
5. The categories of "finance, insurance and real estate" and "transportation, communications and public utilities" will be referred to in this report as "finance" and "transportation" for brevity.

TABLE 22

PER CENT OF NON-AGRICULTURAL EMPLOYMENT BY MAJOR CATEGORIES IN THE BOSTON METROPOLITAN REGION AND OTHER SELECTED AREAS, 1950 and 1960.

PER CENT OF TOTAL EMPLOYMENT

	Construction		Manufacturing		Transportation		Trade	
	1950	1960	1950	1960	1950	1960	1950	1960
Boston Region Areas[2]								
Boston	4.7%	4.4%	30.8%	28.0%	8.3%	6.3%	25.1%	22.4%
Brockton	4.0	4.5	50.3	39.0	9.0	8.3	21.1	23.2
Lawrence-Haverhill	3.0	2.6	63.9	58.6	3.2	2.4	15.1	14.7
Lowell	2.8	4.3	57.8	47.8	4.5	3.5	18.0	19.4
Total Boston Region[3]	4.4	4.3	36.0	31.7	7.7	5.9	23.6	21.7
Other Selected Areas								
Hartford	4.8	4.8	36.1	36.7	4.0	3.9	20.6	19.3
Providence	4.3	4.0	52.5	45.3	5.0	4.8	17.1	18.0
Springfield-Holyoke	3.8	3.3	45.3	42.0	5.7	4.9	19.1	18.9
Detroit	4.4	3.9	51.9	42.9	5.8	6.1	18.0	19.7
New York City	3.5	3.5	28.2	26.8	9.3	9.0	23.6	21.0
Philadelphia	5.2	4.7	42.1	36.8	8.4	7.3	20.5	20.0
Pittsburgh	8.4	6.5	41.8	37.5	9.3	7.8	19.2	19.9
Total United States[4]	7.2	6.6	33.4	30.9	8.9	7.4	21.6	21.0

1. Mining is included in the total and has been distributed in either the construction or service category
2. Metropolitan areas, approximately equal to SMSA's.
3. The total region includes the four metropolitan areas and the outlying territory.
4. For the total United States, Alaska and Hawaii are included beginning in 1959. This represents an increase of 212,000 or about 4% of the total.

areas, but Boston relies to a greater degree on employment in finance and service occupations than most other areas. (Table 22)

A. *Manufacturing Employment in the United States and the Boston Region*

Total employment in the nation's manufacturing industries increased by almost 70% between 1940 and 1950, but the rate of increase slowed to only 12% in the 1950-1960 decade. Because of great strides in automation and work rationalization in recent years, manufacturing employment has not regained its 1953 high point despite continuing rises in output. Between 1950 and 1960 six industries (see Table 23) experienced declines, with major decreases (over 20%) occurring in textiles and lumber products. Textiles is the major loss industry in the Boston region. Large employments gains (more than 20%) were registered in eight of the nations industries. Five of these experienced major (over 30%) expansion in the region: transportation equipment, electrical machinery, rubber, instruments, and pulp and paper. In addition, a substantial gain in employment occurred in its small stone, clay and glass industry.

The Boston Metropolitan Region is a major beneficiary of defense spending. Massachusetts, because of its strength in research and development, was one of the few states in the northeastern quadrant of the nation to increase its proportionate share of research and development prime contracts from the armed forces in the 1953-1961 period. A report by the Department of Defense indicated that Massachusetts received almost 5.8% of defense research and development contracts for the fiscal year of 1961 — a substantial increase over 1953, the last year of the Korean war. During the same period Massachusetts' share of prime contracts for all defense work increased from 2.8% to 4.8% of the nation's total. On the basis of the distribution of Massachusetts' electronics employment and other activities related to military expenditures, it appears likely that as much as four-fifths of the total or about $800 million was allocated to the Boston region. The picture is far less satisfactory with respect to space agency contracts. Massachusetts' share of NASA contracts in 1962 was estimated at about 1%, a situation which may improve with the construc-

TABLE 22 (Continued)

PER CENT OF NON-AGRICULTURAL EMPLOYMENT BY MAJOR CATEGORIES IN THE BOSTON METROPOLITAN REGION AND OTHER SELECTED AREAS, 1950 and 1960.

	PER CENT OF TOTAL EMPLOYMENT							
	Finance		Service		Government		Total No. in 000's[1]	
	1950	1960	1950	1960	1950	1960	1950	1960
	6.7%	6.9%	12.3%	18.8%	12.2%	13.2%	883.8	1,077.9
	.2	2.8	7.8	11.6	7.6	10.6	42.2	39.7
	1.7	3.6	7.2	11.0	5.9	7.1	70.9	74.3
	2.2	2.8	6.4	10.4	8.3	11.6	42.2	42.2
	5.8	6.3	11.3	17.5	11.2	12.6	1,087.8	1,285.4
	13.9	13.1	11.4	11.9	9.2	10.3	172.3	235.9
	3.6	4.3	8.3	12.3	9.2	11.3	291.2	293.4
	5.6	4.8	9.6	14.8	10.9	11.3	164.0	171.9
	3.1	4.2	9.1	12.3	7.7	10.9	1,384.4	1,194.1
	9.3	10.8	15.2	17.4	10.9	11.5	3,528.2	3,557.1
	4.8	5.4	13.2	13.9	5.8	11.9	1,295.5	1,500.8
	3.3	4.2	10.0	14.8	8.0	9.3	882.6	776.6
	4.1	4.9	11.3	13.5	13.5	15.7	44,738.0	54,347.0

Source: U.S. Department of Labor, *Employment and Earnings, 1955 and 1961.* Figures for the Brockton, Lawrence-Haverhill and Lowell areas are from the Massachusetts Division of Employment Security and have been adjusted for full coverage. Employment in Government in these areas has been estimated from census population figures, and assumes that most government workers live in the area in which they are employed. 1950 figures are for Springfield-Holyoke, 1951, for Detroit, 1953, and for Pittsburgh, 1952.

tion of the new $4 million MIT space-research center.[6,7] Most national manufacturing industries altered their employment structure in two ways during the 1950-1960 decade. One basic change was a decline, or at best a leveling off, in production workers. This trend was accompanied by a steep rise in the number and proportion of white collar factory personnel, including administrative, clerical and research workers. Overall, total production-worker employment in the nation's manufacturing remained unchanged between 1950 and 1960, while white collar employment in industry increased by about a third. In numerical terms production worker employment in the nation's manufacturing remain unchanged at about 12 million while non-production factory jobs rose from approximately 3 million in 1950 to over 4 million in 1960. The shift to white collar industrial employment is particularly significant for the Boston region, which is a center of research and administrative activities.

6. *The Christian Science Monitor* (January 7, 1963.)
7. Another indication of the value of tne region's technical resources was the announcement of the new NASA Research Center. To be established within the Boston Region on a one thousand acre site, the Center will provide immediate employment for two thousand persons. It is expected to generate major amounts of R & D and possibly production activities in the region.

B. *Non-Manufacturing Employment*

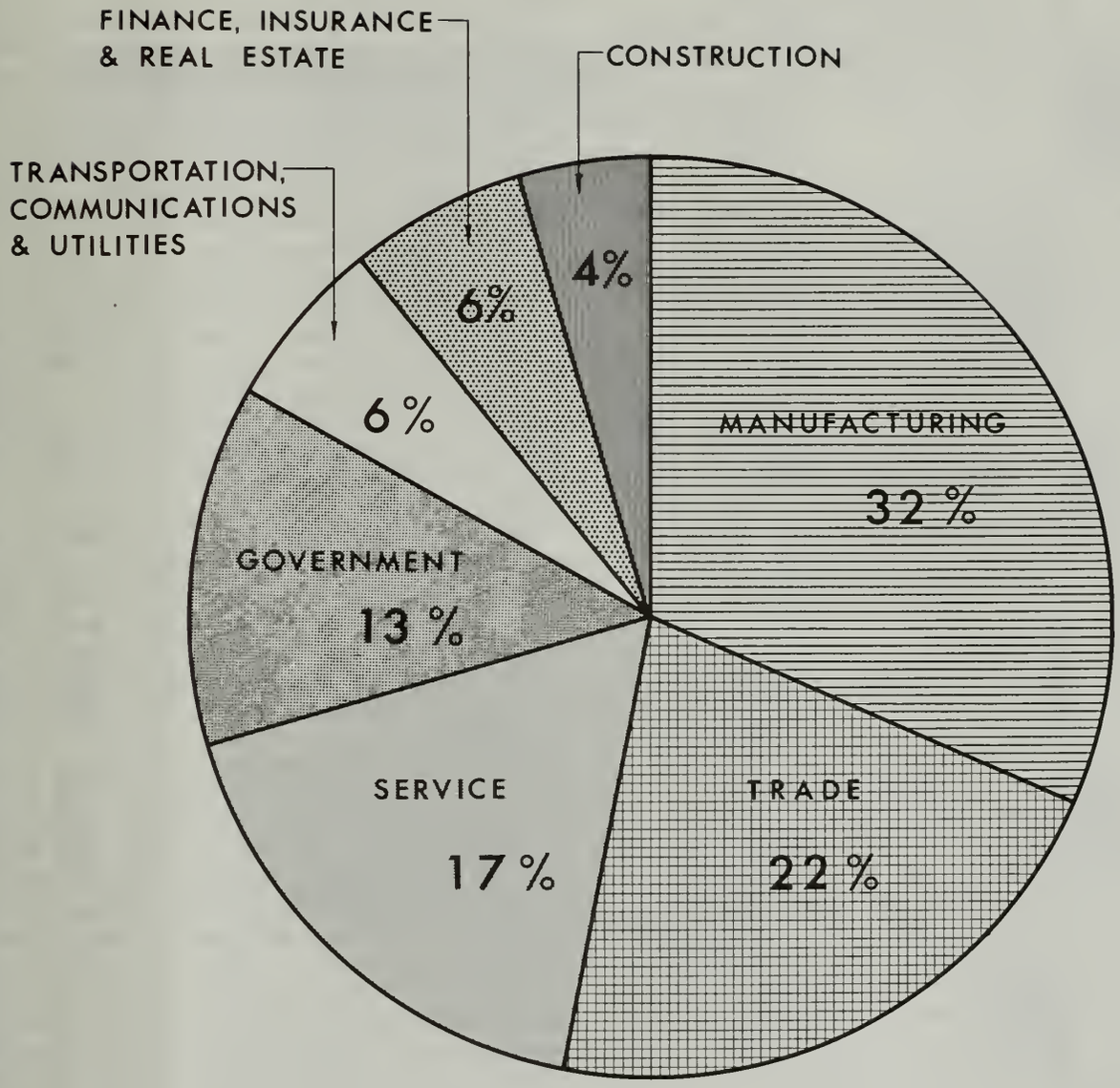
Employment growth in major non-manufacturing sectors of the national economy was substantially greater than the increase in manufacturing employment over the 1950-1960 decade. The 20% expansion of trade employment in the nation in the decade 1950-1960 was in line with population growth. This relationship also held true in the Boston region where population and trade employment both increased by about 9%.

TABLE 23

UNITED STATES MANUFACTURING EMPLOYMENT TRENDS, 1950-1960 and REGIONAL SHARES, 1947 and 1959.

	Total United States Number Employed (000's)			Greater Boston as a Percentage of Employment in the U.S.	
	1950	1960	Per Cent Change 1950-1960	1947	1959
Growth Industries					
Ordnance	30	187	+523.1%	—%	6.5%
Electrical Machinery	877	1,446	+ 64.9	4.9	5.9
Rubber	246	374	+ 52.0	6.8	8.7
Instruments	248	354	+ 42.7	5.9	5.1
Transportation Equipment	1,264	1,617	+ 27.9	0.4	1.3
Printing	738	917	+ 24.3	3.4	2.9
Pulp, Paper	485	593	+ 22.3	2.9	2.8
Chemicals	682	830	+ 21.7	2.1	1.3
Food and Kindred	1,523	1,793	+ 17.7	2.5	2.5
Fabricated Metals	973	1,129	+ 16.0	2.1	1.9
Stone, Clay and Glass	513	595	+ 16.0	0.8	0.8
Moderate Growth Industries					
Machinery (non-electrical)	1,354	1,471	+ 8.6	1.8	1.9
Apparel	1,184	1,228	+ 3.7	2.9	2.6
Furniture	369	383	+ 3.7	1.6	1.4
Primary Metals	1,200	1,229	+ 2.4	0.7	0.7
Moderate Declining Industries					
Leather	392	366	— 6.6	13.7	11.1
Tobacco	103	94	— 8.7	0.3	.2
Declining Industries					
Petroleum	238	212	— 10.9	1.2	0.6
Miscellaneous	453	392	— 13.5	2.6	1.9
Lumber	805	637	— 20.9	0.7	0.4
Textiles	1,298	915	— 29.5	4.8	2.2
Total Manufacturing	14,975	16,762	+ 11.9	2.5	2.5

Source: United States Department of Labor, Employment and Earnings, and Melvin R. Levin and David A. Grossman, *Industrial Land Needs Through 1980,* GBESC Land Use Report No. 2 (May, 1962).



EMPLOYMENT STRUCTURE, BOSTON METROPOLITAN REGION, 1960

SOURCE: U.S. DEPT. OF LABOR, EMPLOYMENT & EARNINGS

In comparison with other urban centers, the Boston metropolitan area is outstanding in two respects:

(1) its relatively high proportion of jobs in business and personal service, finance, and trade, and
(2) its relatively lesser reliance on manufacturing

C. *Intra-Regional Patterns*

The Boston SMSA has far and away the major concentration of non-manufacturing jobs in the region. In contrast to the Boston SMSA, other regional metropolitan centers are relatively underdeveloped in non-manufacturing industries. While less than 30% of the Boston SMSA's labor force worked in manufacturing in 1960, the Merrimack Valley areas and Brockton were as heavily dependent on industrial employment as such major industrial centers as Detroit or Pittsburgh. (See Table 22.) The Lawrence-Haverhill SMSA relies more on manufacturing jobs than the other regional areas with 59% of its labor force in this category. The Lowell SMSA is next with 48% in manufacturing. The Brockton SMSA is the most highly diversified of the three outer areas, with only 39% of its work force engaged in manufacturing activities.

The pattern of 1950-1960 employment changes in the four SMSA's is shown in Figure 18. Since 1950 all three of the region's smaller SMSA's have lessened their emphasis on manufacturing and are beginning to expand in other functions. As compared to 1950, the Brockton and Lowell SMSA's increased in all non-manufacturing categories but transportation. In the Lawrence-Haverhill SMSA, the proportionate share in construction, finance, service, and government has increased over the ten years, but declines have occurred in the transportation and trade categories. In terms of tendencies toward economic diversification, the Boston SMSA has achieved economic diversity; Brockton seems to be well on its way; Lowell is moving forward; and the Lawrence-Haverhill area is lagging.

As these metropolitan areas become more closely linked with the Boston SMSA, they benefit from its growth. Many large electronics firms originally located in the region because of the technical and professional resources of the cities of Boston and Cambridge, but later located new plants in suburban and outlying parts of the region. In addition, an increasing proportion of the Boston area's professional and other personnel are drawn from the three outlying metropolitan areas. As cross-movement between jobs and residences increases, the entire region will become more closely integrated.

D. *Personal Income Trends*

An income balance sheet has not yet been prepared for the Boston region. It appears reasonable, however, to analyze regional income patterns with the help of data for Massachusetts prepared by the U.S. Department of Commerce and 1970 income projections prepared by the Federal Reserve Bank of Boston.[8]

The proportion of Massachusetts personal income contributed by manufacturing is somewhat smaller than it is in the more heavily industrialized states of Rhode Island and Connecticut. In addition, since manufacturing provides less employment in the region than in the state (31% in the region as compared to 36% in the state), industrial wages and salaries provide a substantially smaller share of total personal income in the Boston region than in Massachusetts.

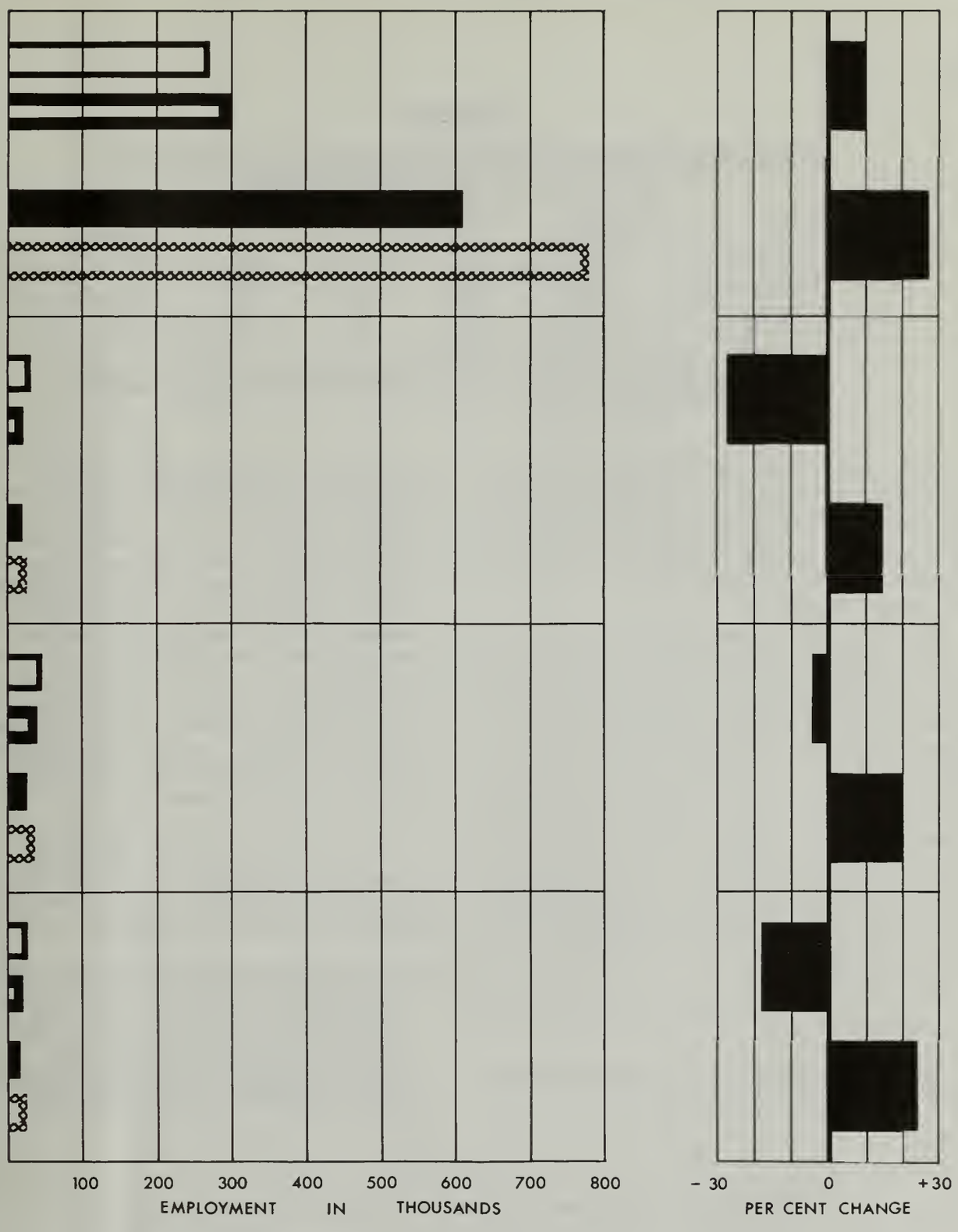
In terms of property income, Massachusetts is on a par with New England, a national center of property ownership and investment. If data for the Boston area, the regional headquarters of investors and other types of property owners could be separated out from state figures, the region would probably be found to derive an even more substantial proportion of its personal income from dividends and rents than is the case in the state as a whole.

Transfer payments account for about 8% of total personal income in the Commonwealth as compared to only 5% in Connecticut and 6% in the nation. However, the percentage is probably far lower in the Boston region than in the state because the Boston SMSA, containing the bulk of regional population, has enjoyed unemployment rates running consistently below the state average.

The Federal Reserve study suggests that the proportions of total Massachusetts personal income derived from wages and salaries will decline while the proportion derived from property income will increase sharply. The gain in the latter is linked to wider ownership of common stocks and realty properties. Within the wage and salary sector, the Federal Reserve study projects a gain in the relative importance of manufacturing and a decline in the significance of government, a departure from national and regional trends. A sharp increase is projected in other labor income, primarily in wages and salaries paid to employees in service and trade activity. The share derived from proprietors income is expected to decline and the share of property income to increase in line with national trends in these two categories. Transfer payments are expected to grow even more in significance to the economy, along with contributions to social insurance. Overall, Massachusetts' share of national income is projected to decline although gains are expected to keep pace with projected population increases.

Trends in per capita income (total personal income divided by total population) are indicated in Tables 24 and 25. Table 24 indicates that Massachusetts per capita income was substantially higher than the nation in 1929 and 1940, fell to only 11% above the U.S. average in 1950 and climbed slightly by 1957.

8. Edwin F. Estle, *New England's Personal Income Projected to* 1970, Federal Reserve Bank of Boston, 1970 Projection No. 12 (December, 1959).



EMPLOYMENT CHANGES 1950 – 1960

1950 MANUFACTURING

1960 MANUFACTURING

1950 NON MANUFACTURING

1960 NON MANUFACTURING

SOURCE: MASSACHUSETTS DIVISION OF EMPLOYMENT SECURITY.
DATA HAVE BEEN ADJUSTED FOR FULL COVERAGE.

TABLE 24

PER CAPITA INCOME IN SELECTED STATES AS A PERCENTAGE OF U.S. PER CAPITA INCOME, 1929-1970

	1929	1940	1950	1957	1970 (proj.)
United States	100	100	100	100	100
Massachusetts	130	132	111	115	112
Connecticut	146	154	128	139	128
Rhode Island	124	125	110	98	105

Source: U.S. Bureau of the Census, *Statistical Abstract of the United States, 1961,* and Federal Reserve Bank of Boston, *New England's Personal Income Projected to 1970.*

Total personal income in Massachusetts is expected to increase (in constant dollars) by 43% between 1957 and 1970, a gain equal to the New England increase but substantially smaller than the 54% gain projected for the nation. Per capita income in the state is also expected to rise, but at a slower rate than in the nation as a whole (Table 25).

The Federal Reserve Bank study expects the leveling process to continue. Massachusetts is expected to slip back to a point about 12% above the national per capita figure in 1970, or roughly to its relative position in 1950. Connecticut, which benefits from an influx of high income residents who commute to New York, has remained well above the national average. However, Connecticut's lead over the national figure is projected to decline to below 30% — roughly its 1950 position. Rhode Island, on the basis of an assumed improvement in its economic prospects, may recapture some of the ground it has lost since 1950. This would once again place Rhode Island close to the Massachusetts level. These changes appear to be related to long term trends toward the reduction of inter-state differentials in per capita incomes.[9]

On the basis of census figures, incomes in the region are near the state level: the 1960 census figures indicated median family income in Massachusetts was $6,300, while the median family income in the Boston SMSA was $6,700 or about 5% higher. Median incomes in Lawrence-Haverhill, Lowell and Brockton was just over $6,000, 5% below the state average. Boston's higher wages and lower unemployment rates and other economic differences between the Boston SMSA and the outlying SMSA's account for the Boston area's higher median income. This differential, however, has been slowly declining. In 1950 median family income in the Boston SMSA was 11% higher than that in the three outlying SMSA's combined, but in 1960 the Boston area was only 9% higher. Increasing "regionalization", including more cross-commuting, will probably narrow the gap still further in coming years.

9. See for example, Harvey S. Perloff and others, *Regions, Resources and Economic Growth,* Resources for the Future, Inc. (Johns Hopkins Press, Baltimore, 1960.)

3. THE MANUFACTURING SECTOR

Industrial employment in the Greater Boston Area[10] between 1947 and 1959[11] rose slightly from 389,000 to 409,000, an increase of 5%. Although the level of em-

10. The statistics on manufacturing employment used in this section are covered data from the Massachusetts Division of Employment Security. The authors express their appreciation to the Greater Boston Economic Study Committee for allowing use of this data, which was developed by GBESC for use in the study, *Industrial Land Needs Through* 1980, Land Use Report No. 2 (May, 1962), prepared for GBESC by Melvin R. Levin and David A. Grossman. In large measure, the analysis as well as data in this section is derived from that report.

11. 1947 represents the first full postwar production year and 1959 the most recent year for which comprehensive employment data for the region were available at the time of th GBESC study.

TABLE 25

PER CAPITA PERSONAL INCOME IN SELECTED AREAS, 1957-1970
(in 1957 dollars)

	Per Capita Personal Income		Projected Increase	Per Cent Increase
	1957	1970	1957-1970	1957-1970
United States	$2,043	$2,568	+$525	+25.7%
Massachusetts	2,346	2,883	+ 537	+22.9
Connecticut	2,855	3,276	+ 421	+14.7
Rhode Island	1,979	2,692	+ 713	+36.0

Source: Edwin F. Estle, *New England's Personal Income Projected to 1970,* Federal Reserve Bank of Boston, 1970 Projection No. 12 (December, 1959).

TABLE 26

MANUFACTURING EMPLOYMENT BY MAJOR CATEGORIES IN THE GREATER BOSTON AREA,[1] 1947-1959

Manufacturing Industry	Employment (000's) 1947	1959	Change 1947-1959 Number (000's)	Per Cent	Per Cent of Total Area 1947	1959
High Growth						
Transportation Equipment	5.1	21.9	+16.8	+329.4%	1.3%	5.3%
Electrical Machinery	39.4	73.0	+33.6	+ 85.3	10.1	17.9
Rubber	17.5	22.6	+ 5.1	+ 29.1	4.5	5.5
Instruments	13.8	17.4	+ 3.6	+ 26.1	3.5	4.2
Stone, Clay and Glass	3.5	4.4	+ 0.9	+ 25.7	.9	1.1
Pulp, Paper	12.9	15.5	+ 2.6	+ 20.2	3.3	3.8
Moderate Growth						
Machinery (non-electrical)	28.1	30.7	+ 2.6	+ 9.3	7.2	7.5
Printing	24.5	25.6	+ 1.1	+ 4.5	6.3	6.2
Furniture	5.3	5.5	+ 0.2	+ 3.8	1.3	1.3
Apparel	30.9	31.6	+ 0.7	+ 2.3	7.9	7.7
Food and Kindred	36.2	36.5	+ 0.3	+ 0.8	9.3	8.9
Primary Meta	7.8	7.8	+ 0.0	+ 0.0	2.0	1.9
Declining						
Fabricated Metals	20.2	20.0	— 0.2	— 1.0	5.2	4.9
Leather	52.4	41.4	—11.0	— 21.0	13.4	10.1
Chemicals	13.5	10.6	— 2.9	— 21.5	3.4	2.6
Miscellaneous	12.3	9.1	— 3.2	— 26.0	3.1	2.2
Tobacco	0.3	0.2	— 0.1	— 33.3	.7	.5
Lumber	4.5	2.9	— 1.6	— 35.6	1.1	.7
Petroleum	2.5	1.4	— 1.1	— 44.0	.6	.3
Textiles	58.3	21.3	—37.0	— 63.5	14.9	5.2
New Industry						
Ordnance	—	9.2	+ 9.2	—	0.0	2.2
TOTAL	389.0	408.6	+19.6	+ 5.0	100.0	100.0

1. The Greater Boston Area for which employment data are presented in this table differs somewhat from the Boston Metropolitan Region. See Figure 19 for a comparison.

Source: Massachusetts Division of Employment Security, through the Courtesy of the Greater Boston Economic Study Committee.

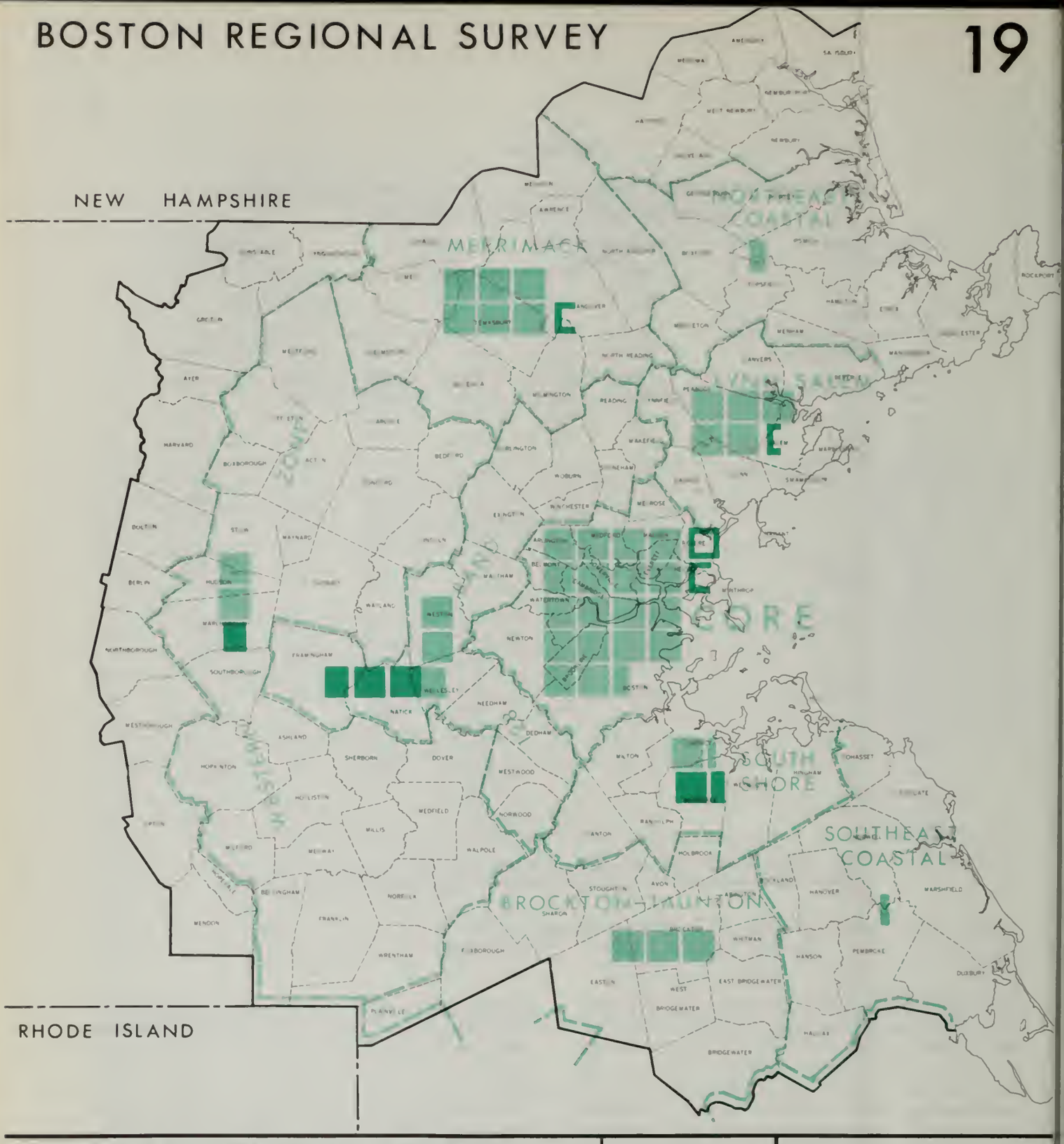
ployment did not change materially, two important structural changes occurred in the regional manufacturing pattern between 1947 and 1959. First, there was replacement of the region's traditional reliance on soft goods industries by technologically advanced hard goods manufacturing. As can be seen in Table 26, three hard goods industries were responsible for a gain of 60,000 jobs: electrical machinery added almost 34,000 employees, transportation equipment 17,000, and ordnance over 9,000.[12] On the other hand, two soft goods industries suffered sharp setbacks. Textile employment declined by 37,000 jobs and leather products by 11,000. Together, these two industries lost five jobs for every six jobs gained in the expanding regional electrical machinery complex. The second change, closely related to the first, involved a shift from a broadly diversified manufacturing structure to the beginning of a concentration in electrical machinery, ordnance, scientific instruments, and other closely related activities. By 1959, these three categories together represented 22% of total manufacturing jobs. Electrical machinery not only rose from third to first place among regional industries in the 1947 to 1959 period but together with the ordnance industry, it produced twice as many jobs as the number two industry, leather products.

The rapid growth in the nation's electrical machinery, instrument and ordnance industries is attributable to the

12. Much of the gain in transportation equipment, however, occurred at a single establishment, the Fore River shipyard, and represented more a return to war time levels of activity than a net gain, while another portion was a statistical change, the result of a reclassification of workers from the electrical machinery to the transportation equipment industry. The increase in ordnance employment is in part the result of a change in the classification of workers who, in most cases, are engaged in activities closely linked to electrical machinery production, and, therefore in reality represents a gain in electrical machinery jobs.

BOSTON REGIONAL SURVEY

19



MANUFACTURING JOBS, 1947–1959

- 10,000 JOBS IN 1947
- 10,000 JOBS GAINED, 1947–1959
- 10,000 JOBS LOST, 1947–1959

SOURCE: GBESC, INDUSTRIAL LAND NEEDS THROUGH 1980

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART BY AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954 AS AMENDED

burgeoning expansion in demand for military and civilian electronics items since the early 1940's. With almost 70,000 persons employed in private electronics firms in 1959, the Boston region was one of four large electronics centers in the nation, the others being Los Angeles, Chicago, and New York. One estimate placed the number of research and development firms in the Boston region at 1,000, more than half of them independent engineering consultant firms. Despite the 1961-1962 "shakeout" in the electronics industry and a decline of speculative investment in electronic stocks with high price-earnings ratios, new firms are being formed on an estimated rate of about 100 per year. Many of these firms are spin-offs from major research institutions and established companies. For example, the Raytheon Company, Massachusetts largest private employer, estimates that 145 new firms have been originated by its former employees. At least 90 science-oriented area firms were founded by MIT faculty and personnel, including Raytheon itself.[13]

With the exception of three industries (ordnance, electrical machinery, and rubber) the Boston Metropolitan Region has not shared to any great extent in the nation's growth industries. In fact, between 1947 and 1959 its employment share in growing industries such as instruments, printing, and chemicals actually declined. Meanwhile the region suffered proportionately in the job decreases which occurred in the nation's six declining industries.

Regional employment in the electrical machinery, ordnance (closely linked to electrical machinery in the region) and instrument manufacturing industries represents over one sixth of national employment in these categories. The regional leather and shoe and rubber industries each have about a tenth of national employment in these industries. All other industries, including the textile industry, are a comparatively minor factor in the nation's industrial landscape, representing on the order of two to three per cent each of national employment in their respective groups.

The Boston region plays a major role in certain aspects of industrial New England, but is not as heavily dependent on manufacturing as the six-state area as a whole. In 1960 the region contained about a third of New England's population but only a little over a fourth of all manufacturing and wholesale jobs. The Boston region dominates New England employment in electrical machinery, providing over half of the jobs in this category. Also, it contains a third of the employment in five industries in the growth and moderate growth classification: apparel, printing, chemicals, rubber, and instrument manufacturing. The region's proportions of some of New England's declining or stable industries (including textiles, primary metals, and non-electrical machinery) is extremely small.

13. "Boom Moves to the Hub", *Business Week*, June 9, 1959

A. *Industrial Structure in Sub-Areas*

A recent study[14] divides most of the region into nine sub-areas which comprise either sectors or rings centered on the city of Boston and other built-up core communities (see Table 27). Each of the sub-areas appear to have a reasonable degree of unity. However, inevitably, some communities at the edges of a sub-area tend to share certain characteristics of a neighboring sub-area. Newton, for example, is in many ways a part of the Route 128 western group of municipalities despite the fact that it borders directly on Boston. In addition, a number of sub areas (including Brockton-Taunton, Merrimack, and Lynn-Salem) contain communities with central city characteristics as well as suburban and rural towns. Despite these limitations, the sub-areas are reasonable working approximations of Greater Boston's economic components.[15] Data summarizing sub-area manufacturing job changes can be found in Table 27.

Another aspect of manufacturing concentration in the region is shown in Figure 20, which indicates the major centers of manufacturing employment on a community basis.

a. *Core Communities*

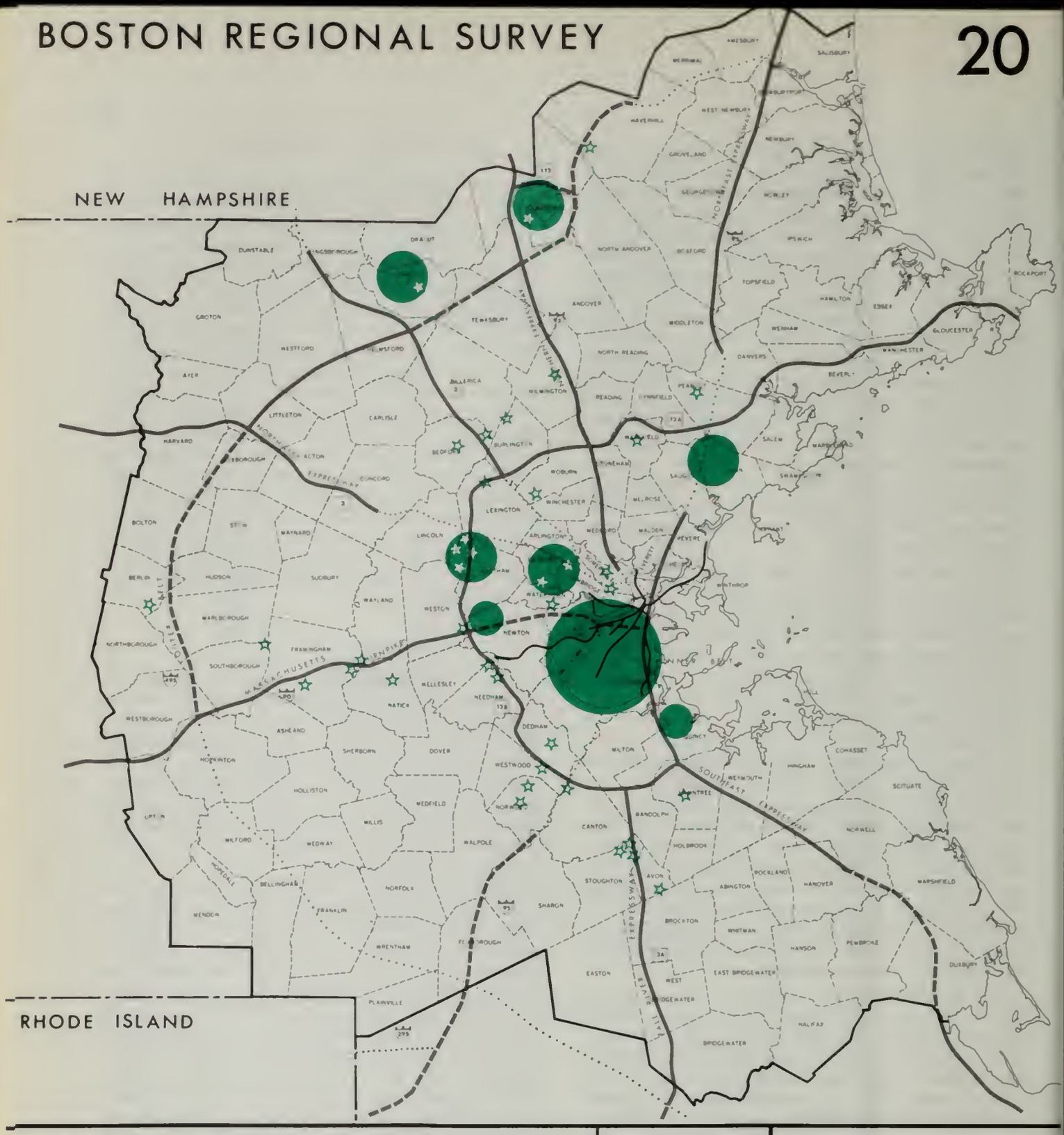
The 15 core communities contain only 6.6% of the region's total land area but nearly half of its industrial employment and population. The core contained over 50% of all jobs in 1959 in a number of manufacturing industries including: food, apparel, printing and publishing, furniture, chemicals, rubber products, and primary and fabricated metals. Core-oriented industries include neither electrical machinery, the region's leading growth industry, nor textiles and leather products, the main declining industries.

The city of Boston is the chief industrial center within the core, providing about 60% of core manufacturing jobs. In the industrial category, Boston occupies a dominant position in several industries traditionally associated with central city location; the apparel and printing industries, for example, require good access to a large, low wage labor pool and to downtown financial and business services. In addition, Boston provides one third of the regional employment in miscellaneous manufacturing, and a fourth of the regional total in instruments and non-electrical machinery. On the other hand, Boston contains only 10% of electrical machinery employment. Cambridge, the only other industrial center of any magnitude, provides about one quarter as many jobs in manufacturing as Boston. Other core employment centers are Newton, Watertown, Somerville and Everett. Together they contain over 30,000 manufacturing jobs, about a third as many as Boston.

14. Levin and Grossman, *Op. cit.*
15. The nine sub-areas omit a number of communities within the Boston Metropolitan Region but include one industrial center which is not included in the region: Taunton. For the most part the omitted communities contain little industrial activity, and Taunton is a relatively small industrial center (7,000 manufacturing employees).

BOSTON REGIONAL SURVEY

20



MAJOR CENTERS OF MANUFACTURING EMPLOYMENT

MANUFACTURING JOBS, 1959

- OVER 30,000
- 20,000 – 30,000
- 10,000 – 20,000

☆ INDUSTRIAL PARKS IN OPERATION, 1961

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 | 2560 ACRES

SQUARE MILES

0 5 10 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THRU URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

Trends similar in some respects to those in the region as a whole characterized the core area in the 1947 to 1959 period. There was a marked (58%) increase in electrical machinery employment. This increase, however, was concentrated in a very few communities, generally lying outside the central cities. Newton, for example, secured two-thirds (4,600 jobs) of the core area increase in this category, while Boston gained only 1,000 electrical machinery jobs. The core experienced losses in textiles, food processing, apparel, leather goods, and fabricated metals. Boston bore the brunt of this loss and was the primary contributor to the 8% manufacturing employment decline in the core between 1947 and 1959.

b. *The Route 128 Area*

The bulk of regional suburban industrial expansion in the 1947-1959 period occurred in the 16 communities adjoining Route 128 to the west of the core area. The Route 128 area contains approximately one-eighth of the region's population, land area and manufacturing jobs.[16]

Electronics is the major industry along Route 128. In 1959 the electrical machinery industry supplied just over a third of the sub-area's total manufacturing and wholesale employment. In fact, almost a fourth of all regional electrical machinery jobs were concentrated here. Other major industries in the Route 128 area include: instruments, pulp and paper, non-electrical machinery production, and printing. Together, these four industries supply an additional 28% of the sub-area's manufacturing jobs and 17% of regional employment in these categories.

In manufacturing terms, the most important communities in the Route 128 area are those due west of Boston. Over 60% of the sub-area's electrical machinery jobs are concentrated in Lexington and Waltham. Furthermore, almost two-thirds of total manufacturing employment in the Route 128 communities are located in plants on or near the expressway. The northern and southern extremities of the Route 128 area have experienced a slower rate of industrial expansion than the rest of the sub-area.

In the 1947 to 1959 period the Route 128 area sustained minor losses in textiles, leather, lumber and primary and fabricated metals employment, but the loss amounted to less than 2,000 jobs. In contrast, there was a six-fold, 17,000 job increase in electrical machinery employment. This was accompanied by substantial gains in several other industries, particularly non-electrical machinery employment. The result was a near doubling of industrial employment between 1947 and 1959, the most striking gain of any of the component areas of the region. This gain placed the Route 128 area in second place in the region in terms of numbers of manufacturing workers, where it had ranked fifth in 1947.

16. Two of the communities included in this group, Framingham and Natick, are not located directly on Route 128 but are immediately to the west on Route 9 and the Massachusetts Turnpike.

TABLE 27

MANUFACTURING EMPLOYMENT BY SUB-AREAS OF THE GREATER BOSTON AREA, 1947-1959.

	Manufacturing Employment (000's)		Per Cent of Total Area	
	1947	1959	1947	1959
Boston Metropolitan Area[1]				
Core	184.7	166.5	47.5%	40.7%
Route 128 Band	28.0	54.2	7.2	13.3
Lynn-Salem	50.0	45.2	12.9	11.1
South Shore	12.8	27.5	3.3	6.7
Southeast Coastal	2.5	2.8	.6	.7
Lawrence-Lowell Metropolitan Area[2]				
Merrimack Valley	59.3	52.0	15.2	12.7
Brockton-Taunton[3]	28.7	28.8	7.4	7.0
Outlying Areas				
Northeast Coastal	3.8	4.3	1.0	1.1
Western	19.2	27.3	4.9	6.7
TOTAL	389.0	408.6	100.0	100.0

1. The listed sub-areas correspond generally to the Boston SMSA.
2. The Merrimack Valley sub-area corresponds generally to the combined Lowell and Lawrence-Haverhill SMSA's, excluding Haverhill.
3. The Brockton-Taunton sub-area includes most of the Brockton SMSA. See Figure 19 for sub-area boundaries.

Source: Massachusetts Division of Employment Security.

c. *Lynn-Salem*

The major industrial centers of Lynn, Peabody, and Salem lie to the northeast of Boston. They contain about 5% of the region's land area, but provide approximately 11% of regional manufacturing and 10% of its jobs and population. The major industries are electrical machinery, non-electrical machinery, leather, and transportation equipment. Together, these four industries provide almost four-fifths of the Lynn-Salem area's industrial jobs and 22% of regional employment in these categories.

Lynn-Salem, a long established industrial area, experienced a decline in industrial employment between 1947 and 1959. The area's 7% job loss in the 12 year period was occasioned by substantial declines in leather products; textiles and surprisingly, in electrical machinery employment. The latter was partly a result of reclassification, some of the apparent loss being concealed in gains of about 5,000 jobs each in transportation equipment and non-electrical machinery.

d. *South Shore*

To the southeast of Boston is the eight-community South Shore area traversed by a recently constructed extension of Route 128 and the Southeast Expressway containing from six to seven per cent of the region's land area, population, and industrial jobs. Most South Shore employment is concentrated in Quincy, Braintree, and Weymouth. The area's principal industry is shipbuilding. The Fore River shipyard is the source of about 40% of the area's manufacturing jobs. Electrical machinery, representing 12% of South Shore employment, is primarily concentrated in Braintree.

Over the 1947-1959 period the South Shore transportation equipment industry experienced the most impressive numerical gain of all South Shore industry, an increase of 9,400 employees. Employment in electrical machinery, another growing industry on the South Shore, increased from only 100 in 1947 to 3,300 in 1959. In all, the South Shore more than doubled its share of regional employment, rising from 3% in 1947 to 7% in 1959.

e. *Outlying Sub-Areas*

Two of the five outlying sub-areas, Brockton-Taunton and the Merrimack Valley, contain sizable urban centers with concentrations of manufacturing employment. The remaining three sub-areas are lightly populated with farm land and small town centers mingled with residential subdivisions.

The Brockton-Taunton area contains about 14% of the region's land area and about half that proportion of its population and industrial jobs. The city of Brockton, traditionally strong in shoe production, has about 9,000 manufacturing employees, 4,000 of whom are in the leather industry. Taunton, a jewelry center, has 7,000 industrial jobs, of which nearly 2,000 are in jewelry and silverware production.

The level of manufacturing employment remained stable in the Brockton-Taunton area between 1947 and 1959, despite a 40% decline in leather and shoe jobs. The 4,000 job loss in the leather category, which had particularly adverse effects on Brockton, was counterbalanced by gains in instruments and other industries.

The second major urban center in the outlying areas of the region is the Merrimack Valley, containing the cities of Lawrence and Lowell. This area experienced a remarkable transformation in its industrial economy over the 1947-1959 period. The Merrimack Valley experienced a precipitious (31,000) decline in textile jobs. These were partially replaced by a gain of 16,000 jobs in electrical machinery and ordnance, 4,000 in leather goods and apparel, and lesser expansions in other industries. As a result of these gains in non-textile industries, total Merrimack Valley manufacturing employment decreased by only 12% between 1947 and 1959, in spite of a 70% job decline in the dominant textile industry.

The three remaining sub-areas do not play a major role in regional industrial employment. They contribute only about 8% to the region's total industrial employment even though they occupy 45% of the region's land area. The Northeast Coastal area, stretching from Rockport-Gloucester on the east to Middleton on the west, contains 10% of the region's land area, but only 2% of its population and 1% (4,000) of its manufacturing jobs. The Southeast Coastal area includes Marshfield, Scituate, and other communities which combine suburban, resort, and rural functions. This area contains one-tenth of the region's land area and 2% of its population but less than 1% (2,500) of its manufacturing jobs. The third outlying sub-area is a large crescent-shaped territory to the west of Boston reaching from the Rhode Island border in the south almost to the New Hampshire line in the north. This 29-community area contains a fourth of the region's land but only 6% of its population and industrial jobs. It has been a major beneficiary of the rapid expansion of the electrical machinery industry; almost 9,000 of its 27,000 manufacturing jobs are derived from this source. Most of the electrical machinery employment, however, is found in three of the areas 29 communities: Bedford, Wayland and Concord, all of which are near Route 128.

B. *Industrial Wage Rates*

Manufacturing industries in the Boston region are concentrated primarily in the medium wage categories. Average factory wages in the Boston labor market area, which provided 84% of regional industrial jobs in 1960, were on a par with the nation and the New York area but substantially below levels in other major urban centers. (Table 28). However, wages in the Boston area are well above levels in adjacent metropolitan areas, including Lawrence-Haverhill, Lowell and Brockton. The

TABLE 28

AVERAGE HOURLY EARNINGS OF PRODUCTION WORKERS IN MANUFACTURING FOR SELECTED LABOR MARKET AREAS, 1951 and 1960.

Area	Average Hourly Earnings 1951	1960	Per Cent Change 1951-1960
Massachusetts	$1.50	$2.09	+39.3%
New England Labor Market Area			
Boston	1.53	2.25	+47.1
Providence-Pawtucket	1.39	1.87	+34.5
Hartford	1.68	2.40	+42.9
Other Labor Market Areas			
New York City	1.67	2.26	+35.3
Detroit	1.94	2.92	+50.5
Philadelphia	1.62	2.38	+46.9
Pittsburgh	1.79	2.80	+56.4
Chicago	—	2.49	—
United States	$1.59	$2.26	+42.1%

Source: U.S. Department of Labor, *Employment and Earnings.*

Boston areas wage lead over Massachusetts as a whole increased during the nine-year period 1951-1960; the Boston average factory wage was only 2% higher than the average for the Commonwealth in 1951 but higher in 1960.

As can be seen in Table 29, the region is no longer dominated by low wage industries. The proportion of factory jobs derived from low wage industries dropped from 42% of the total in 1947 to 27% in 1959. Most regional low wage industries experienced a sharp decline in the twelve-year period, with textiles leading the loss group. In contrast, employment in eight medium wage industries rose, with electrical machinery and ordnance scoring the most impressive gains. Since the percentage of jobs in five high wage industries in the region did not change materially between 1947 and 1959, it is apparent that gains in medium wage industries were the principal elements in the region's upward shift in factory wage levels.

By 1959 the percentage of factory jobs provided by low wage industries had decreased to a level close to that in the nation as a whole, while the proportion derived from medium wage industries was higher than in the nation.

TABLE 29

PER CENT DISTRIBUTION OF EMPLOYMENT IN MANUFACTURING INDUSTRIES BY WAGE GROUPS[1] IN THE GREATER BOSTON AREA, 1947 and 1959.

Wage Category	Per Cent in Each Wage Group			
	Greater Boston Area		United States	
	1947	1959	1949	1959
High Wage Group	14.8%	16.1%	24.7%	24.8%
Medium Wage Group	43.1	56.5	44.5	50.8
Low Wage Group	42.1	27.4	30.8	24.4
Total Number Employed (in 000's)	389.0	408.6	14,149.8	16,666.7

1. High wage group: earnings of $2.50 or over per hour in 1959. Medium wage group: $2.00-2.49 per hour in 1959. Low wage group: under $2.00 per hour in 1959.

Source: United States Department of Labor, *Employment and Earnings* for average hourly earnings in manufacturing industries. The industries comprising each wage group were assumed to be the same for the Boston area and the United States. Boston area employment figures are from Melvin R. Levin and David A. Grossman, *Industrial Land Needs Through 1980.* GBESC Land Use Report No. 2 (May, 1962).

TABLE 30
RETAIL SALES IN THE BOSTON METROPOLITAN REGION SMA's AND CENTRAL CITIES, 1948, 1954 and 1958.

Area	Total Sales in millions			Sales Per Capita		
	1948	1954	1958	1948	1954	1958
SMA's				$ 924	$1,226	$1,347
Boston	$2,190	$3,010	$3,385	856	1,004	1,060
Brockton	111	153	178	877	902	1,047
Lawrence	110	120	144	692	863	987
Lowell	101	126	153			
Cities				1,327	1,788	1,923
Boston	1,063	1,321	1,340	1,104	1,253	1,414
Brockton	69	86	103	1,137	1,281	1,537
Lawrence	92	96	109	953	1,178	1,429
Haverhill	45	53	66	929	1,102	1,304
Lowell	90	104	120	—	—	—
Boston CBD	423	420	403			
Area Outside Regional SMA's	345	375	404			
Total Region	$2,857	$3,784	$4,265			

4. THE NON-MANUFACTURING SECTOR

A. *Retail Trade*

The Boston region is one of the nation's leading retail centers, with over four billion dollars spent in its retail establishments in 1958. Retailing is also a major source of regional employment. In 1960, 22% of the region's non-agricultural jobs were derived from this category. Although it is well behind New York, Los Angeles and Chicago, the region is on a par with the Philadelphia and Detroit areas and well ahead of San Francisco and Pittsburgh.

In the past decade major changes have occurred in the structure of metropolitan areas that have had an important impact on the functions and importance of central cities within these great urban complexes. One of the most significant trends is suburbanization. Best known in its housing and population aspects, suburbanization has also affected the retail sales pattern, although not to the same extent as in population and housing. Virtually every major central city in the nation except San Francisco experienced losses in shares of metropolitan retail sales from 1948 to 1958. Many central business districts, Boston's included, have actually declined in absolute sales volume.

As can be seen in Table 30, regional sales in retail trade are overwhelmingly concentrated in the Boston SMSA.

The Boston SMSA accounted for almost 80% of the region's total receipts in 1958, the date of the latest Census of Business.[17] The three other metropolitan areas of the region accounted for 11% of the receipts with the remaining portions of the region accounting for 9% of regional retail sales. The Boston Central Business District is the major retail center in the region. In 1958 retail volume in the few hundred acres of territory that constitute downtown Boston was $403 million, almost a tenth of the regional total and more than the four outer cities combined.

In terms of trends, the region as a whole increased by almost 33% in retail sales volume between 1948 and 1954 and by an additional 13% in the four years between 1954 and 1958. This represents an increase of from three to four per cent annually over the decade. Component metropolitan areas within the region differ from the regional pattern, although the shares of each have remained about the same. (See Table 31.)

Regional central cities, while increasing in total receipts from retail sales in the ten years from 1948 to 1958, accounted for smaller proportions of their metropolitan area sales in 1958 than in 1948. The central city of Boston has lost more than the other regional central cities or suburban areas. In the ten year period from 1948 to 1958, the city of Boston increased in retail sales by 26% while the fast-growing suburban territory on or near Route 128 more than doubled in retail sales volume.

Brockton has not followed the pattern of the other three regional metropolitan areas in regard to suburbanization of sales. Brockton achieved a greater percentage gain in the 1954 to 1958 period (19%) than did the total metropolitan area (16%). However, the circumstances in Brockton are unusual in that it contains a substantial amount of open, developable land and in recent years has exhibited population and land use trends more characteristic of a suburb than a declining central city. For example, suburban-type shopping centers have been established within the corporate limits of

17. Retail sales data available from the U. S. Census of Retail Trade of 1948 and 1958 are based on the 1950 definition of the metropolitan area, rather than the 1960 Standard Metropolitan Statistical Area. See Figure 3 in the *Population* chapter for a comparison of the 1950 and 1960 definitions.

TABLE 30 (Continued)

RETAIL SALES IN THE BOSTON METROPOLITAN REGION SMA's AND CENTRAL CITIES, 1948, 1954 and 1958.

Per Cent of Regional Total			Per Cent of SMA			Per Cent Change in Total Sales	
1948	1954	1958	1948	1954	1958	1948-1954	1954-1958
76.6%	79.5%	79.4%				+37.5%	+12.5%
3.9	4.1	4.1				+38.4	+16.4
3.9	3.2	3.4				+ 8.7	+20.2
3.5	3.3	3.6				+24.8	+20.8
37.2	34.9	31.4	48.6	43.9	39.6	+24.2	+ 1.5
2.4	2.3	2.4	62.7	56.2	57.7	+24.2	+19.4
3.2	2.5	2.6	84.4	79.8	75.5	+ 4.6	+13.8
1.6	1.4	1.6	—	—	—	+17.7	+24.9
3.2	2.7	2.8	88.2	82.1	78.7	+14.9	+15.8
14.8	11.1	9.5	18.3	15.1	12.6	— .8	— 3.8
12.1	9.9	9.5				+ 8.7	+ 8.0
100.0	100.0	100.0				+32.5	+12.7

Source: *U.S. Census of Business, 1948, 1958* and *1958*. Figures for "Area outside Regional SMA's" are estimates based on a sample of cities and towns outside regional SMA's.

TABLE 31

PER CAPITA RETAIL SALES BY MAJOR CATEGORIES IN BOSTON METROPOLITAN REGION SMA's AND CENTRAL CITIES, 1948 and 1958 (in 1948 dollars)

Category	Standard Metropolitan Areas				Central Cities			
	Boston	Brock-ton	Law-rence	Lowell	Boston	Brock-ton	Law-rence	Lowell
Total								
1948	$ 924	$ 856	$ 877	$ 692	$1,327	$1,105	$1,137	$ 929
1958	1,107	871	858	810	1,580	1,162	1,261	1,070
General Merchandise								
1948	131	65	53	72	346	110	77	96
1958	138	85	77	72	286	167	143	117
Apparel								
1948	81	74	120	72	151	112	179	96
1958	82	77	81	59	143	149	129	99
Furniture								
1948	40	36	59	38	65	64	84	48
1958	48	33	42	31	79	60	72	48
Food								
1948	222	228	226	208	276	263	297	270
1958	268	248	234	221	291	276	307	258
Drug								
1948	32	25	31	21	33	29	38	22
1958	36	24	30	30	46	32	44	35
Automotive								
1948	108	112	91	65	94	130	107	77
1958	144	111	112	99	151	125	177	136
Other								
1948	310	316	297	216	362	397	355	320
1958	391	293	282	298	584	353	389	377

Source: *U.S. Census of Business, Retail Trade, 1948* and *1958* and *U.S. Census of Population, 1950* and *1960*.

the city. In addition, an important competition, the South Shore Shopping Plaza, located within ten miles of downtown Brockton, was not opened until 1961.

Haverhill was not included by the Census Bureau in the Lawrence area until 1960 and while it does not maintain the sales volume of Lawrence, it has not experienced a serious decline in retail activity. Haverhill is probably aided by the fact that it serves adjacent suburban New Hampshire communities as well as some in Massachusetts.

The other two regional areas, Lawrence and Lowell, follow the Boston pattern to some extent. The city of Lawrence increased its retail sales by only 19% between 1948 and 1958 while in the rest of the Lawrence area the increase was 87%. In Lowell the situation is even more striking. Sales in the central city increased by a third but the area outside of the city trebled in retail trade volume, aided considerably by suburban growth trends.

Perhaps the most striking effect of retail suburbanization is found in central business district retail sales trends. For example, over the 1948 to 1958 decade, the Boston CBD experienced a 5% loss in retail sales volume. Since the greatest part of this loss occurred in the 1954 to 1958 period, the downward thrust seems to have increased its momentum.

A factor which must be taken into account in evaluating changes in retail sales is inflation. Prices as reflected in the Bureau of Labor Statistics' Consumers Price Index, rose by about 20% during the 1948-1958 decade.[18] This probably indicates that retail sales volume would have had to be 20% greater in 1958 than in 1948 just to off-set inflation. Measured in constant uninflated dollars, sales volumes in the Boston CBD actually decreased by a fourth between 1948 and 1958, while retail trade in the region as a whole gained by only about a fourth.

One of the more interesting phenomena shown in Table 31 is the rise in per capita sales in central cities. A gain in per capita sales indicates that sales have been rising faster than population or, in cases where population has declined, that sales have not dropped proportionately. Assuming that residents of cities do not spend much more per capita on retail goods than suburbanites, relatively high per capita retail expenditures in the central cities represent sales made to suburban shoppers. Viewed in these terms, regional central cities, especially Boston and Lawrence, were still capturing a substantial proportion of the retail spending of suburban residents in 1958.

a. *Retail Trade by Category*

The overall pattern of retail sales by major functional components is illustrated in Figure 21 for the Boston SMSA. The patterns for the three smaller SMSA's of the Boston region are generally similar.

The substantial overall increase in regional retail volume in the 1948-1958 decade conceals a number of significant variations among the various sales categories (see Table 32). Six categories, (general merchandise, apparel, furniture, food, drugs, and automotive sales) provide about two-thirds of the retail sales in the nation and region. Two of the six, food and automotive sales, increased by major amounts from 1948 to 1958. In the Boston SMSA for example, a $150 million rise in food sales and a $100 million increase in automotive sales were responsible for almost 40% of the area's total increase in retail volume (measured in constant dollars) during the decade. Even more significant, the food and

18. U. S. Bureau of the Census, *Statistical Abstract of the U. S.* and U. S. Department of Labor, Bureau of Labor statistics.

TABLE 32

RETAIL SALES BY MAJOR CATEGORIES IN BOSTON METROPOLITAN REGION SMA's AND CENTRAL CITIES, 1948 and 1958 (in 1948 dollars)

	Total Sales[1] (millions)		General Merchandise		Apparel		Furniture	
	1948	1958	1948	1958	1948	1958	1948	1958
SMA								
Boston	2,190	2,781	311	346	193	207	94	121
Brockton	110	147	8	14	10	13	5	6
Lawrence	109	119	7	11	15	11	7	6
Lowell	102	125	10	11	10	9	5	5
Cities								
Boston	1,063	1,101	277	199	121	100	52	55
Brockton	70	84	7	12	7	11	4	4
Lawrence	92	90	6	10	14	9	7	5
Lowell	89	99	9	11	9	9	5	4
Boston CBD	423	336	208	166	74	47	18	17

1. Retail sales totals may differ from those in other tables because of rounding.

automotive group were the source of fully half of the increase in the region's other three metropolitan areas.

Measured in constant dollars, rising real incomes in the region in the decade 1948-1958 were reflected in a 20% rise in total retail sales directed, to a considerable extent, toward increased spending for food and beverages and on automobiles and other automotive equipment. In the Boston SMSA approximately $200 more per capita was spent for retail goods in 1958 than in 1948. Of this $200 gain, $46 went for food and $36 for automotive equipment. The bulk of the remainder of the increase ($81) went for the "other" category, a miscellany which includes gas service stations, restaurants, lumber and building materials, liquor stores, garden supply stores, jewelry stores, camera stores, and other specialty stores. Only $17 of per capita gains was captured by general merchandise stores, $1 by apparel stores, $8 by furniture stores, and $4 by drug stores.

In contrast to food and automotive sales, volume in the general merchandise and apparel groups increased moderately in the 1948-1958 decade, rising by less than 14% in the case of general merchandise and only 5% in the case of apparel. This was not a uniform pattern, however, both the Lawrence-Haverhill and Brockton metropolitan areas scored major gains in general merchandise sales. The Brockton metropolitan area, site of growing regional shopping centers within the city borders, also registered a major (30%) gain in apparel sales. The city of Brockton alone increased by 50% in apparel sales volume and 70% in general merchandise. In contrast, Lawrence's $4 million increase in general merchandise volume was coupled with a $5 million decline in apparel sales, suggesting that a greater number of consumers shopped for clothing in department stores in 1958 than was true a decade earlier.

The significant change in regional retail trade structure between 1948 and 1958 has a number of locational implications. The suburbs of the Boston metropolitan area were the major beneficiaries of the shift in retail sales location. The most impressive gains occurred in categories which usually oriented toward automobile shopping and located outside Central Business Districts. General merchandise (which includes department and variety stores) and apparel, which together provided two-thirds of Boston CBD sales in 1958, were the region's slowest growing categories. Major decreases in both categories were experienced by Boston and its CBD between 1948 and 1958. Part of the decline in regional mass transit patronage is linked to the decline in retail sales in downtown Boston and other centers oriented toward transit shoppers.

Measured in constant dollars, Boston declined by a total of $100 million in general merchandise and apparel sales in the 1948-1958 decade. Meanwhile, the rest of the Boston metropolitan area increased sales in these two "downtown" categories by about $150 million.

Furniture, which resembles general merchandise and apparel with respect to central city concentration — almost 40% of 1958 Boston area sales were derived from establishments located in the city of Boston — rose slightly in sales volume in the city during the decade. Once again, Boston's suburbs experienced the major increase; their $24 million increase in the decade was responsible for two-thirds of the regional gain in this category.

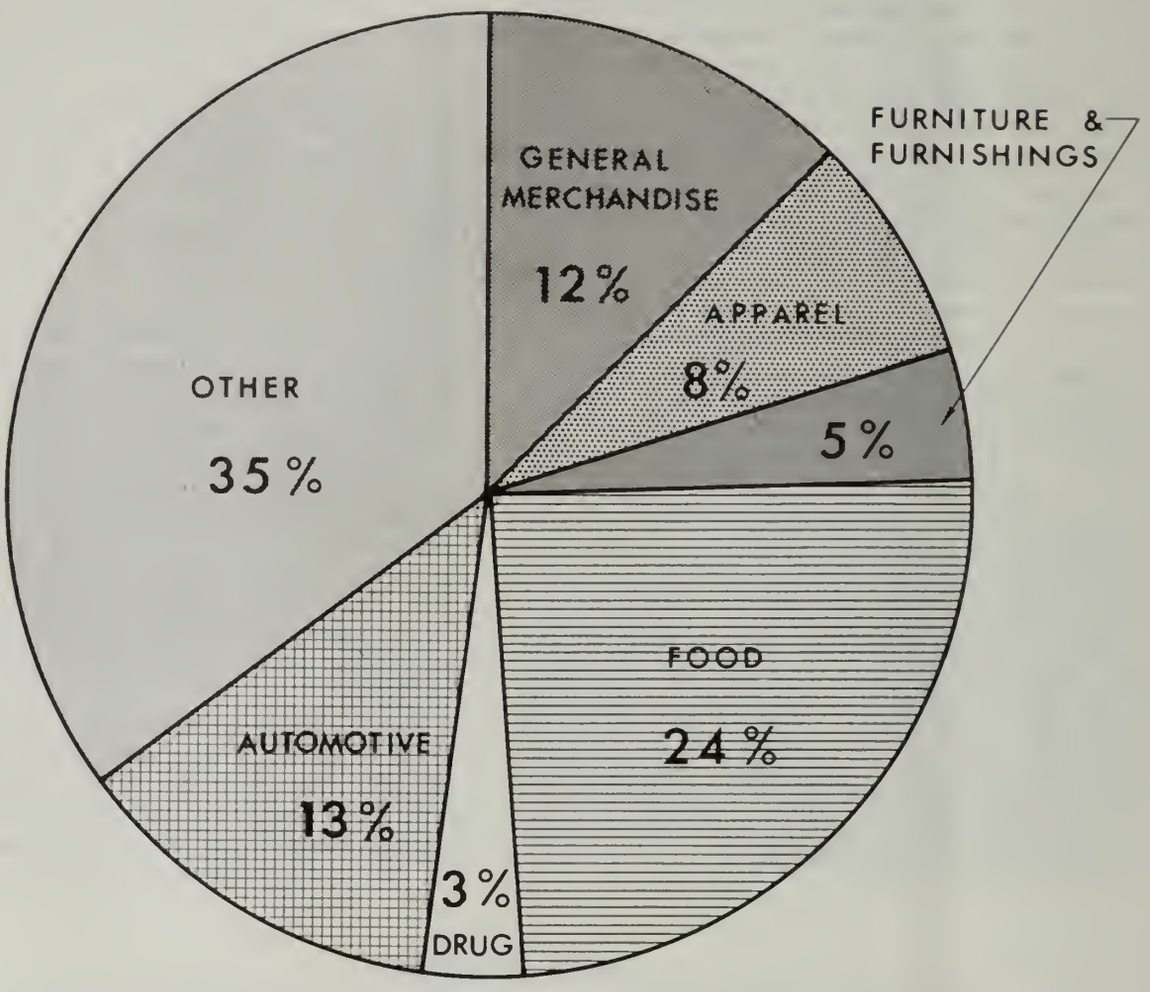
Food tends to be among the most neighborhood-oriented of the retail categories. Food sales declined in the city of Boston in the decade by almost 10% while population declined by 13%. This major regional growth category is a minor component of CBD

TABLE 32 (Continued)

RETAIL SALES BY MAJOR CATEGORIES IN BOSTON METROPOLITAN REGION SMA's AND CENTRAL CITIES, 1948 and 1958 (in 1948 dollars)

Food		Drug		Automotive		Other	
1948	1958	1948	1958	1948	1958	1948	1958
527	672	76	91	257	360	732	984
29	42	3	4	14	19	41	49
28	32	4	4	11	16	37	39
28	34	3	5	9	15	37	46
222	203	26	32	75	105	290	407
17	20	2	2	8	9	25	26
24	22	3	3	9	13	29	28
26	24	2	3	7	13	31	35
20	11	4	4	1	5	98	86

Source: *U.S. Census of Retail Trade, 1954* and *1958*. 1958 data have been adjusted to SMA area. To adjust sales figures 1958 sales were reduced by 17.9%.

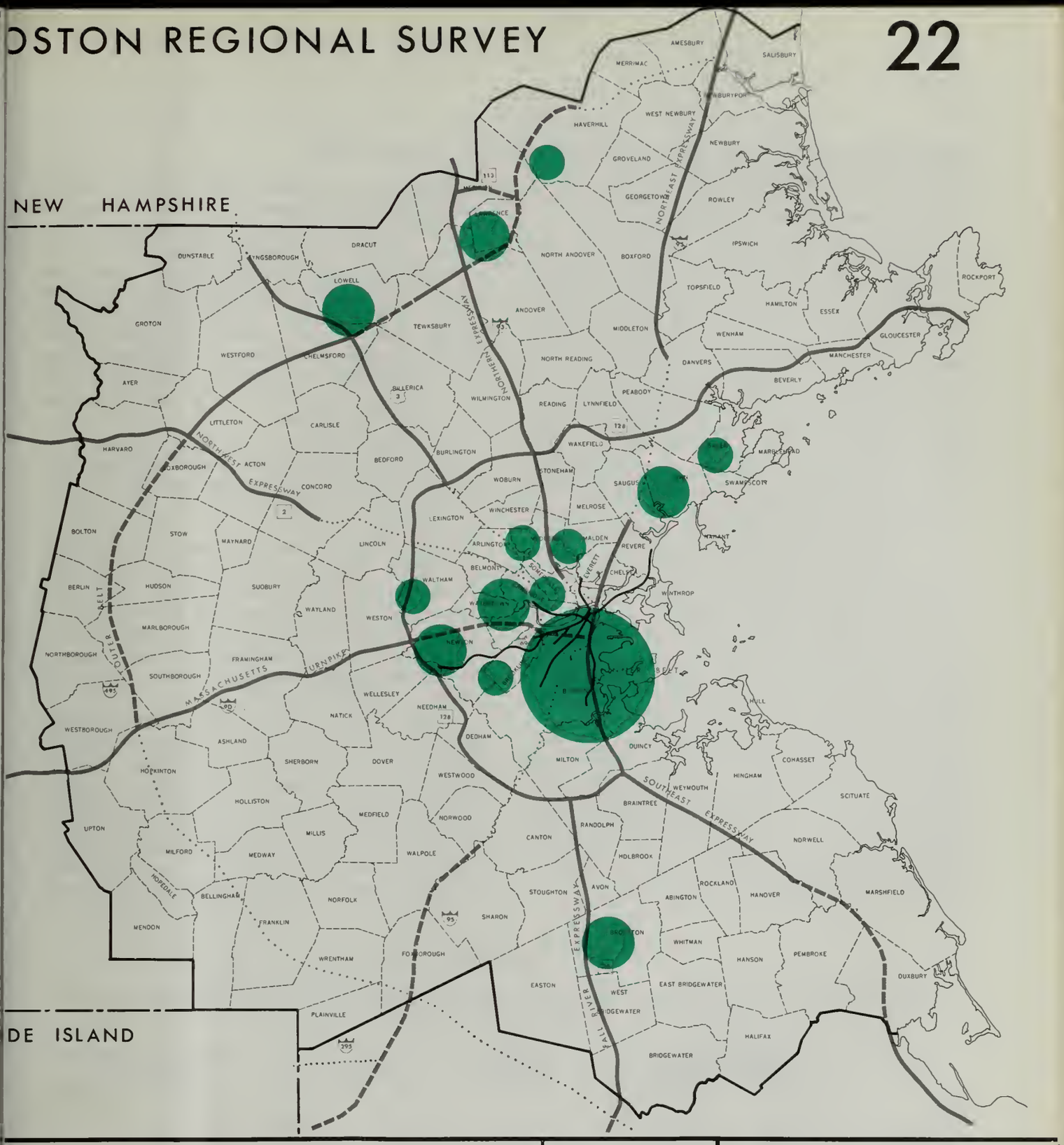


RETAIL SALES BY MAJOR CATEGORIES, BOSTON SMA, 1958

SOURCE: U. S. CENSUS OF RETAIL TRADE, 1958

OSTON REGIONAL SURVEY

22



MAJOR CENTERS OF RETAIL SALES

RETAIL SALES, 1958

- OVER $1,000 MILLION
- $ 100 - $1,000 MILLION
- $ 50 - $ 100 MILLION

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
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SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

RED FOR THE MASS TRANSPORTATION COMMISSION

THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

sales, providing only 3% of the total in 1958. Boston's suburbs where most of the region's population growth occurred, were responsible for about two-thirds of the increase in regional food sales in the decade.

Automotive sales are usually concentrated in urban strip developments and consequently most central cities have claimed a major share of the substantial increase in this category. The Boston and Lawrence percentage of area sales was unchanged between 1948 and 1958, and while Brockton declined, Lowell increased its share. Boston and Lawrence's population decline did not trigger a similar desertion by automobile dealers.

The central cities had not yet begun to feel the full impact of postwar suburban competition by 1958, the latest business census year. Only one of the Boston area's five largest regional shopping centers (Shoppers World at Framingham) was in operation prior to 1958. The North Shore shopping center at Peabody and Chestnut Hill at Newton did not go into full operation until late in 1958. The South Shore Plaza did not begin operation until 1961 and the Saugus operation opened in September 1959. Additional regional, quasi-regional, and junior retail shopping centers in operation or planned for construction before 1965 will not only provide a really serious test of the competitive abilities of central city and secondary CBD retailing, but also will trigger a major battle for retail sales between numerous suburban and core area shopping complexes.

Two accompanying maps, Figures 22 and 23, graphically illustrate major features in the region's retail sales pattern. Figure 22 shows the cities with annual sales volumes in excess of $50 million; except for the outlying metropolitan centers, all are located within Route 128. Figure 23 illustrates the growing pattern of planned suburban shopping centers in the region, based on a recent survey conducted for the *Boston Globe*.

B. *Wholesale Trade*

Employment in wholesale trade represents approximately a sixth of employment in the trade category and 3% of all regional employment: In the nation 5% of employment is in the wholesale category. While wholesale trade is not prominent in terms of number employed, dollar volume sales exceed those for retail trade and the rate of increase in wholesale trade volume and jobs indicates that it is one of the region's growth sectors. However, the 9% increase in wholesale employment between 1947 and 1958 was exceeded by an increase in sales in the same period of about 20%, measured in constant dollars.

The Boston SMSA dominates sales in this sector of the regional economy, with 96% of all wholesale sales. The Brockton and Lawrence areas together account for only 3% of all regional wholesale trade and the Lowell area only 1%.

Suburbanization is the major feature of the wholesale category, albeit to a somewhat lesser extent than is the case in retailing and manufacturing. Table 33 illustrates this trend in the cases of the Boston and Lowell areas. The Brockton and Lawrence areas, neither of which plays a major role in wholesaling as compared to Boston, exhibit mixed trends with respect to suburbanization of wholesale trade.

In recent years, manufacturers, particularly in large corporations, have increased the practice of establishing a system of regional and local warehouses to distribute their products as opposed to construction of numerous manufacturing branch plants. This method of distribution permits closer control over centralized manufacturing operations and offers considerable flexibility in serving local and regional markets. Many of the new warehouses have been built on or near major expressways in

TABLE 33

WHOLESALE SALES IN BOSTON METROPOLITAN REGION SMA's AND CENTRAL CITIES, 1948, 1954 and 1958.[1]

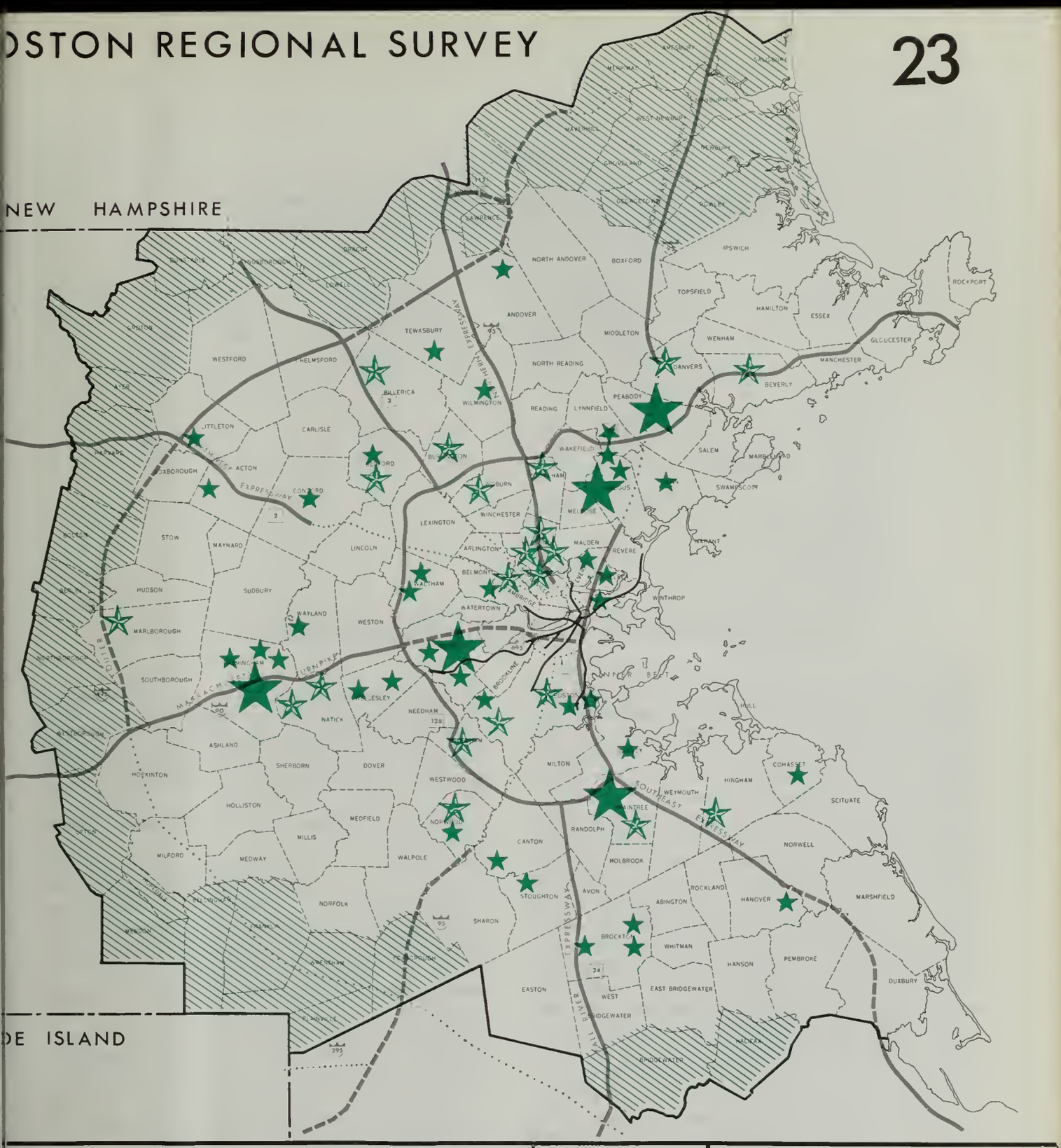
Area	Total Sales (millions of dollars) 1948	1958	Per Cent Inerease 1948-1958	Per Cent of all SMA's 1948	1958	Each City as a Per Cent of its SMA 1948	1958
SMA							
Boston	$5,156	$6,018	+16.7	97.2%	96.3%		
Brockton	48	95	+97.1	.9	1.5		
Lawrence	62	89	+43.3	1.2	1.4		
Lowell	36	5i	+43.1	.7	.8		
Cities							
Boston	4,567	3,987	—12.7			88.5%	66.2%
Brockton	42	82	+96.5			86.3	91.6
Lawrence	57	77	+34.9			92.5	87.1
Lowell	30	42	+34.5			84.5	81.9

1. 1958 Sales are reduced by 12.4% to offset increases in the Wholesale Trade Index in the 1948-1958 decade.

Source. *U.S. Census of Business, Wholesale Trade, 1954* and *1958*.

OSTON REGIONAL SURVEY

23



PLANNED SHOPPING CENTERS

- REGIONAL
- COMMUNITY
- NEIGHBORHOOD
- NO DATA

SOURCE: THE BOSTON GLOBE, SHOPPING CENTERS AND SHOPPING DISTRICTS IN THE BOSTON MARKET, APRIL, 1962.

D FOR THE MASS TRANSPORTATION COMMISSION

THE PLANNING SERVICES GROUP, CONSULTANTS

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

2560 ACRES = 1 SQUARE MILES

0 5 10 MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

TABLE 34

SELECTED SERVICE RECEIPTS IN BOSTON METROPOLITAN REGION SMSA's AND CENTRAL CITIES, 1954[1] and 1958

SMSA	Total Receipts (millions) RECEIPTS IN EACH YEAR 1954	1958	Per Cent of Total Personal Services 1954	1958	Misc. Business Services 1954	1958
Boston	$412	$588	27.4%	22.9%	28.7%	39.8%
Brockton	11	16	45.5	44.2	10.6	14.4
Lawrence-Haverhill	15	21	49.4	42.2	6.5	11.0
Lowell	9	11	49.3	51.2	4.9	9.9
TOTAL FOR SMSA's	447	636	29.1	24.6	27.0	37.7
Cities						
Boston	252	339				
Brockton	7	9				
Lawrence & Haverhill	11	14				
Lowell	8	10				

1. The 1954 figures are for SMA areas except that the city of Haverhill was added to the Lawrence SMA in 1954 to make the 1954 coverage more comparable with 1958.

suburban locations. As a result, Boston's share of wholesale trade volume has been declining. Measured in constant 1948 dollars, the city of Boston lost 13% of its 1948 trade volume by 1958; meanwhile, an impressive 245% gain in wholesale sales occurred in the metropolitan area outside the city of Boston.

Analysis of community wholesale patterns indicates that Cambridge is the second city in the region with almost $450 million in wholesale sales. Cambridge volume was only about 10% of the Boston level but was almost twice as great as the combined total of the region's four outer cities. After Cambridge, the centers of retail trade in the region are Newton and Watertown, with $230 million and $180 million in sales respectively. The increase in wholesale volume in the cities and towns within the Boston SMSA outside the city of Boston between 1948 and 1958 was far in excess of that in any other section of the region.

C. *Services*

Services are becoming an increasingly important component of national and regional employment. In 1960 approximately 14% of national non-agricultural jobs and 18% of regional employment was provided by the service category. The sales increase in regional service establishments between 1950 and 1960 was twice as great as the increase in retail sales volume. In this category some degree of suburbanization is apparent in such trends as the increasing pace of highway-oriented motel and drive-in theater construction in suburban and outlying areas, as compared to relative stagnation among taxi and transit-oriented downtown hotels and movie theaters. However, strong central city concentration is still evident in most service activities. Within the region as a whole, the Boston area captures over 90% of service receipts with over 50% accounted for by the city of Boston, proportions which have changed little since 1954.

The service category, an extremely broad classification, includes: (1) business services such as advertising, photo finishing and blueprinting; (2) personal services such as beauty shops, barber shops, laundries and cleaning establishments; (3) repair operations such as automobile repair shops and appliance repairs; and (4) lodging and entertainment services. The business services have been expanding sales rapidly in recent years, while the other categories have declined in terms of their proportion of total receipts. In the region as a whole, business services contributed almost 40% to total service receipts in 1958, a sharp gain over 1954. Furthermore, the business services have increased their sales shares in each of the region's four metropolitan areas.

In contrast to business services, other sectors of the services category tend to be highly susceptible to technological changes. Home beauty care and shoe-shining, permanently pleated and wash and wear garments, and home laundry equipment have had an adverse effect on personal services receipts. Admissions to some types of commercial recreation facilities have suffered in competition with television and other types of consumer recreation. On the other hand, automobile and appliance repair volume increased substantially throughout the region, reflecting the increased ownership (and growing complexity) of motor vehicles and consumer appliances.

TABLE 34 (Continued)

SELECTED SERVICE RECEIPTS IN BOSTON METROPOLITAN REGION SMSA's AND CENTRAL CITIES, 1954[1] and 1958

Misc. Repair Services RECEIPTS IN EACH YEAR 1954	1958	Amusement inc. Motion Picture 1954	1958	Total Per Cent Increase 1954-1958	Per Cent of All SMSA's 1954	1958	Each City as a Per Cent of its SMSA 1958	1954
6.8%	6.1%	18.8%	14.1%	42.8%	92.1	92.4		
12.0	11.0	12.6	10.2	47.7	2.5	2.6		
19.4	21.0	13.1	9.3	34.8	3.4	3.3		
12.4	9.4	17.7	11.1	25.9	2.0	1.7		
7.4	6.7	18.4	13.8	42.2	100.0	100.0		
				34.6			61.0	57.5
				15.8			66.6	52.1
				29.6			68.1	65.5
				24.2			86.7	85.6

Source: *U.S. Census of Business. Selected Services, 1954* and *1958.*

D. *Government*

Federal, state and local government employment is one of the nation's major sources of jobs and in the past three decades government has been one of the fastest growing sectors of the economy. In the 1950-1960 decade, employment in government increased by 50%. Aside from the armed forces, there are about nine million government workers in the nation, one-sixth of total non-agricultural employment. Of this total, only 2.2 million are federal employees. Most of the remaining 6.8 million (70% of the total) are local government workers, and three-fourths of these are school teachers or employed in school administration. The major growth in the past decade has been in state and local government; the federal payroll increased by only 10% between 1950 and 1960, rising only about half as fast as the rate of population expansion. In contrast, total state and local jobs rose by 75%, almost four times faster than population, most of the increase being attributable to rising school enrollments.

Much of the same trend has been apparent in the Boston region, where federal, state and local government provide about an eighth of total non-agricultural employment. Table 35 indicates that the increase in government jobs in the region in the past decade has been proportionately greater than population gains. Total government employment in the four regional SMSA's between 1950 and 1960 rose by almost a third, as compared to a combined population gain of less than 10%.

TABLE 35

GOVERNMENT EMPLOYMENT IN BOSTON METROPOLITAN REGION SMSA's, 1950-1960

SMSA[1]	Employment (000's) 1950	1960	Per Cent Increase 1950-1960
Boston	107.5	142.2	+32.3%
Brockton	3.2	4.2	+31.3
Lawrence-Haverhill	4.2	5.3	+26.2
Lowell	3.5	4.9	+40.0
TOTAL FOR SMSA's	118.4	156.6	+32.3%

1. The Division of Employment Security's definition of Metropolitan Areas is approximately equal to Bureau of Census SMSA areas. The Division of Employment Security does not include government in its covered employment counts. These figures are available for the Boston area in Employment and Earnings. Employment in government in the other three areas has been estimated from Census figures. (See also notes to Table 22).

Source: U.S. Department of Labor, *Employment and Earnings,* and *U.S. Census of Population, 1950* and *1960.*

E. *Finance, Insurance and Real Estate*

Finance, insurance and real estate is one of the nation's growth industries. National employment in the category grew by 36% between 1950 and 1960, achieving a level of almost 2.5 million in 1960. Impressive percentage increases occurred in insurance carriers (41%) and banks and trust companies (55%) and the security dealer and exchange group (68%). Only a modest (13%) gain occurred in finance agency and real estate employment.

Finance, insurance and real estate is a particularly critical sector of the economy for large urban centers. It is of considerable significance therefore that gains in this category are found within major metropolitan areas, and are concentrated in central business districts. Gains in insurance and finance (real estate employment has been relatively stable) have compensated for much of the employment lost in downtown areas as a result of the relocation of manufacturing industries to the suburbs. Among other effects, this trend has helped to compensate for the decreases in journey-to-work riders on mass transit systems which resulted from the decline in core area manufacturing activities.

The Boston region has experienced much of the same pattern of employment change in this category as the nation. The bulk of employment, as might be expected, is found in the Boston SMSA which contained 92% of all regional employment in finance in 1960 (compared to 95% in 1950), most of it concentrated in downtown Boston. As is the case in many other facets of the region's economy, regional dominance by Boston has been diminishing but in this instance the decline is extremely slow. While the actual level of employment in the region's three other SMSA's and outlying territory is not high, (6,500 in 1960), their combined growth in finance employment was a sizable 50% between 1950 and 1960.

The pattern of growth in Boston is similar to that in the nation in several respects. As in the nation, employment in securities and investment experienced the largest (55%) percentage increase in the Boston SMSA between 1950 and 1960, and banking follows with a 45% increase.

a. *The Finance Function*

The Boston region's important role in the nation's financial pattern is only partly indicated by employment figures. Boston has traditionally been a leading center of commercial banking, investment and trust activity. As measured by the origination and distribution of security issues and by the number of large institutional and private buyers, the Boston area occupies a tertiary position behind New York and Chicago. Clearly Boston is New England's financial hub: In 1959, 22 underwriting firms had their main offices in Boston as compared to only 15 firms (most of them relatively small) which had their main office elsewhere in New England. Boston is also a leader in insurance. The life, fire and marine and casualty groups located in New England account for about a fifth of the assets of these institutions in the nation, and Boston and Hartford contain most of New England's insurance headquarters. The assets of New England investment trusts, most of them centered in Boston, represent over 30% of the total assets of the nation's open end trusts.[19] Aided by a well founded reputation for prudent management, Boston has traditionally been a leader in the investment business. Within New England, Boston provided much of the capital for the textile industry, the railroads, and public improvements. In addition Boston capital helped to finance ventures in other parts of the nation, including such diverse efforts as the copper industry, electrical equipment and public utilities, automobiles, communications, and household products.

With the unification of the nation's capital market, Boston has lost much of its distinctive position in the marketing of securities. As a rule, Boston firms now originate only local issues, particularly in such fields as electronics, and smaller sized municipal issues. Much of the current underwriting activity of Boston investment houses is as participants with firms elsewhere in the nation. However, Boston has been a leader in the formation of risk capital enterprises including the American Research Development Corporation and a number of small Business Investment Corporations which have provided funds for a number of technologically advanced industries in the region and elsewhere in the nation.

Boston commercial banks also play a significant part in providing operating capital for business and industry as distinct from the equity capital provided through investment banks. In addition to satisfying local needs, substantial amounts of capital have been loaned to firms outside the region, including commodity operations, the oil and motion picture industry, and real estate ventures.[20]

F. *Transportation, Communications, and Public Utilities*

National employment in the transportation, communications and public utilities category has remained essentially stable in the past ten years. Increasing by only 1% in the 1950-1960 decade, employment in this category attained a level of about four million in 1960. Two major cross currents have occurred within the category. Employment in communication and public utilities increased while the larger transportation sub-category declined. Since utilities and communications represent only 37% of total employment in the category, they do not have as great an effect on the trend for the group as does transportation. The moderate (11% increase in communication and public utilities jobs in the decade barely counterbalanced the 6% decline in transportation employment.

The decline in national transportation employment is almost entirely attributable to a decline in the interstate railroads. Employment in this sub-category declined by 400,000 in the decade. Reductions in local railways and bus lines were responsible for a decrease of 35,000 jobs. On the other hand, employment in trucking and ware-

19. Federal Reserve Bank of Boston, *A History of Investment Banking in New England*, Annual Report for 1960.

20. Federal Reserve Bank of Boston, *Commercial Banking in New England* 1784-1958 (1959).

housing increased by over 200,000. This lends some support to the assertion that changes in taste and technology which cause a decline in employment in one part of the economy usually work to increase job levels in other industries.

Regional employment in transportation declined by 9% in the 1950 to 1960 period, most of the loss occurring in the Boston SMSA.

G. *Construction*

Contract construction provided about 5% of the non-agricultural jobs in the nation and 4% in the Boston region in 1960. Levels of construction employment are closely associated with population expansion as reflected in home building and related activities. Until the mid-1950's this was one of the nation's fastest growing industries, employment having more than doubled between 1940 and 1956. However, partly because of changes in equipment and techniques, there has been little change in construction employment levels in the past six years.

The total dollar value of construction in the nation increased by two and one-half times in the 1950 to 1960 decade, but in Massachusetts the increase was only about 50%. So far as can be determined (changes in classification make precise comparisons hazardous) regional employment changes were consonant with trends in construction activity.

5. ECONOMIC PROJECTIONS

It is hazardous to prepare precise employment predictions in view of the uncertainties created by the rapid pace of change in modern technology. Such factors as automation, competition between different types of goods and services, and the future role of national defense in the economy, are apt to play major roles in determining the 1970 and 1980 patterns of regional industrial employment. The broad projections and analysis of trends presented below should be viewed in terms of the assumptions upon which they are based. They are intended to indicate the general direction and overall magnitude of employment growth in the region rather than its detailed composition and geographic distribution.

The projections for future levels of regional employment are based on several sources. Employment projections for manufacturing industry, which is in many ways the mainstay of the regional economy, are taken from the industrial land needs study prepared for the Greater Boston Economic Study Committee[21] which was in turn largely based on New England projections prepared for the Federal Reserve Bank of Boston.[22] Employment trends for the non-manufacturing sector of the regional economy have been based on overall regional labor force projections prepared by GBESC[23] and an extrapolation of the recent population and employment trends in the Boston Metropolitan Region presented in this and preceding reports of the MTC's Boston Regional Survey. Another source that has been utilized as a general guide is a set of projections developed for the New York Metropolitan Region.[24]

In general, it appears that the Boston region can look forward to a productive ten years in the period between 1960 and 1970. Gains in employment may more than keep pace with projected population growth. Manufacturing employment is expected to increase by almost 17%, with gains concentrated in the electronics and related industries. Among the non-manufacturing sectors, employment in finance, service and government are expected to increase substantially; however, trade and construction employment, both closely linked to population trends, may rise only moderately. Only the transportation category is likely to decline as a source of jobs, a trend which seems inescapable in view of the inroads of the private motor vehicle and continued automation in the field of transportation.

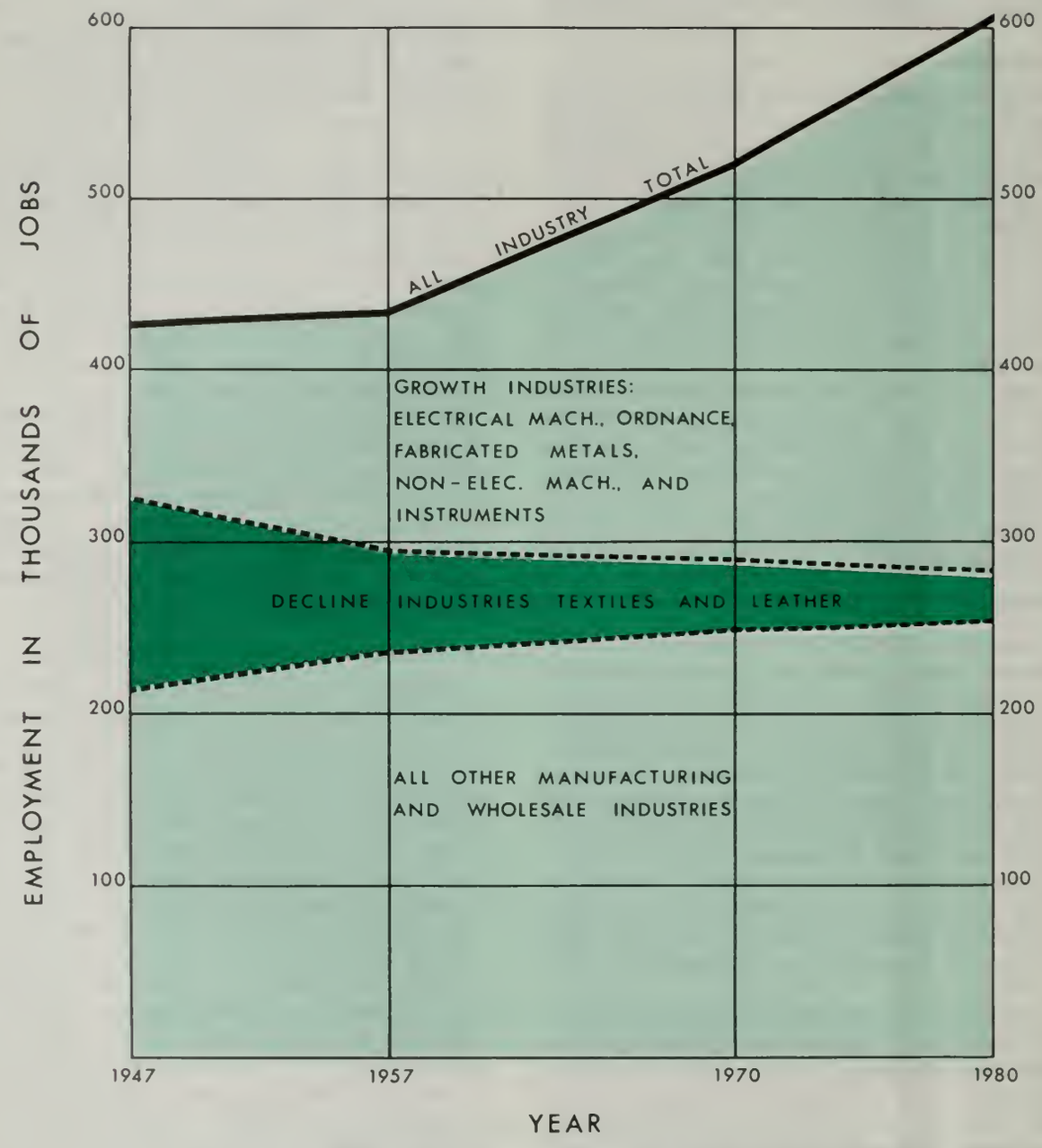
It also appears likely that the regional distribution of employment will change substantially by 1970. The bulk of employment increases in government, finance, and services will undoubtedly occur in and around the city of Boston since these categories are traditionally central city-oriented. In contrast, manufacturing and retail trade will probably continue to display continued tendencies toward suburbanization.

A. *Manufacturing Employment Projections*

Projections for 1970 manufacturing employment in Greater Boston indicate a considerable improvement in the region's employment level as compared to 1957 (and 1959) levels.[25] This is contingent on major gains in electronics employment. If this actually occurs, the region's industrial employment will probably expand substantially, since the loss potential in the declining textile and leather manufacturing categories has been drastically reduced by past declines in these industries.

In contrast to a job gain of less than 2% between 1947 and 1957, a 20% increase is forecast from 1957 to 1970. Gains are expected to be concentrated in only a few industries, particularly electrical machinery. The projection of striking increases for the electrical machinery industry by 1970 is based on a retention of the region's 1957 share of projected New England 1970 employment in this category. The Boston region significantly increased its share of New England electrical machinery jobs between 1947 and 1957 (from 36% to 53%). Greater Boston's gain in this category was

21. Levin and Grossman, *Op. cit.*
22. T. Y. Shen, *New England Manufacturing Industries in* 1970, 1970 Projection No. 1, prepared for the Federal Reserve Bank of Boston.
23. Everett J. Burtt, *The Labor Force of Greater Boston,* Economic Base Report No. 1, prepared for the GBESC (June, 1959).
24. B. R. Berman, B. Chinitz, and E. M. Hoover, *Projection of a Metropolis* (Harvard University Press, Cambridge, Massachusetts, 1961).
25. Industrial employment projections for New England prepared by the Federal Reserve Bank of Boston were used in a recent GBESC study as the basis for these Greater Boston projections. It should also be noted that these projections were made as a basis for forecasting future land use needs. For further information, see Levin and Grossman, *Op. cit.*



MANUFACTURING EMPLOYMENT IN GREATER BOSTON PROJECTED TO 1980

SOURCE: GBESC, INDUSTRIAL LAND NEEDS THROUGH 1980

greater than that for all New England; the six-state area outside Greater Boston experienced a net employment loss in this national growth industry during this period. (See Figure 24.)

The total industrial job gain forecast for 1970-1980 is approximately equal to that projected for the 1957-1970 period. Again, the largest gains are predicted to occur in the electrical machinery and instruments categories, both of which are technologically advanced industries for which the region appears to have significant locational assets. Further losses are anticipated in textile and leather employment with textiles, once the mainstay of the region, being reduced to relative insignificance by 1980. Fortunately, other regional industries appear ready to compensate for these textile losses. Comparisons of the 1970 and 1980 projections of manufacturing employment with anticipated labor force figures for the region suggest a continuation of the 1947-1959 pattern of about a third of the labor force engaged in industrial activities.

B. *Sub-Area Manufacturing Projections*

The projections of sub-area shares of Greater Boston manufacturing employment shown in Table 36 are based on extrapolations to 1970 and 1980 of the changes in sub-area shares of regional employment between 1947 and 1957.[26]

26. Significant departures were made from this technique in the case of four industries where unusual conditions were involved: non-electrical machinery, electrical machinery, transportation equipment and instruments. See Levin and Grossman, for an explanation of the changes. *Op. cit.*

As noted in Table 36 further substantial increases in industrial employment are forecast for the Route 128 area, along with appreciable gains in the Western and South Shore areas. In addition, a reversal of the 1947-1959 loss is projected for the Merrimack Valley area. On the other hand, the level of industrial jobs is expected to remain stable in the core itself as well as in the Lynn-Salem area.

The Industrial Land Needs study suggested that less reliance be placed on the sub-area projections than those for the region as a whole, since added uncertainty has been injected in determining how the various sub-areas will share in regional employment.

Moreover, in assessing the reliability of any of the employment projections in the GBESC industrial land report, it should be remembered that they were prepared as a basis for forecasting future land needs and not as independent projections for employment. The projections probably err in the direction of optimism to estimate the region's maximum possible needs for new industrial land.

C. *Employment Trends for Non-Manufacturing Industries*

Employment in non-manufacturing industries has not received the detailed analysis that is available for manufacturing. However, in order to present a coherent framework for expected regional employment, non-manufacturing employment must be considered.

Three non-manufacturing growth categories are projected to increase more rapidly than total employment:

TABLE 36

MANUFACTURING EMPLOYMENT IN MAJOR SUB-AREAS OF THE GREATER BOSTON AREA,[1] 1947-1957 AND PROJECTIONS FOR 1970 and 1980.

	Employment (000's)				Per Cent of Total Greater Boston Area			
	1947	1957	1970	1980	1947	1957	1970	1980
Boston Metropolitan Area								
Core	218	205	192	201	50.9%	47.0%	36.9%	33.1%
Route 128 Band	29	46	89	118	6.8	10.6	17.1	19.4
Lynn-Salem	51	49	49	56	11.9	11.2	9.4	9.2
South Shore	13	23	33	38	3.0	5.3	6.3	6.3
Southeast Coastal	3	3	5	10	0.7	0.7	1.0	1.6
Lawrence-Lowell Metropolitan Area								
Merrimack Valley	61	53	77	88	14.2	12.2	14.8	14.5
Brockton-Taunton	30	28	31	38	7.0	6.4	6.0	6.3
Outlying Areas								
Northeast Coastal	5	5	7	9	1.2	1.1	1.3	1.5
Western	19	25	38	49	4.4	5.7	7.3	8.1
TOTAL AREA	428	436	520	607	100.0	100.0	100.0	100.0

1. See notes to Table 27. Where percentages do not sum to 100.0% errors are due to rounding.

Source: Melvin R. Levin and David A. Grossman, *Industrial Land Needs Through 1980,* GBESC Land Use Report No. 2 (May, 1962).

finance, services, and government. Substantial growth in these categories is occurring throughout the nation and is concentrated in major metropolitan areas.

Trends toward continued increases in government employment are occurring throughout the nation and the Boston region is expected to share in this trend. Regional employment in government is likely to maintain its present share (about 2%) of nationwide government employment.

A high rate of projected increase in finance employment is anticipated, closely related to the fact that participation in investment programs is increasing among the large middle income segment of the population and is beginning to reach into lower economic strata. Although some suggest that automation may decelerate or reverse the trend toward increased employment in offices including financial institutions, this may not be the case. Banks and insurance companies have devoted a good deal of attention to the use of complex computer equipment in recent years, but to date, the chief results have been a speedier flow of information and paperwork rather than cutbacks in personnel. Opinions concerning the future are divided between those who believe that the end product of the coming decade of accelerating automation will decrease jobs available for finance and other office employees and those who feel that a combination of rising business volume and a desire for increasingly complex and faster communications will continue to expand employment in this category.[27]

A diversified and complex economy creates major demands for varied and specialized services. Projections of continued substantial employment growth in the service occupation rests on the fact that they are labor intensive. Growth in the services has primarily been due to expansion of business services such as advertising, credit and collection agencies, and research and consulting organizations which require face-to-face contacts.

Only one employment category is expected to decline in numbers. Transportation, communication, and public utilities, a category which is extremely susceptible to automation, is expected to decline by about 2% below the 1960 level by 1970. The future outlook for transportation technology and consumer markets seems to point to employment trends through the 1970's not significantly different from those of the past decade. Automation and other factors may drive railroad and public transportation employment levels down even further, but increases in jobs in trucking and in the growing communications and utilities industries are likely to counterbalance these losses.

Employment in retail and wholesale trade and construction activities is projected to increase only moderately, since growth in these occupations is loosely tied to population and income trends. The region's expanding (and considerably more affluent) population will create demands for larger numbers of homes, schools, and other community facilities, thereby affecting levels of construction and trade employment. If regional population grows more than the anticipated 10% growth in the next ten years, employment in construction and trade may well grow even faster. However, trends toward greater automation of retail and construction activities may weaken the stimulus generated by population gains and rising incomes.

Construction is an activity subject to a considerable amount of automation and rationalization. The use of large scale machinery and production line techniques has advanced fairly rapidly in recent years, slowing increases in employment. Due to the nature of a large part of the construction industry which operates on a seasonal custom basis it has not been easy to apply assembly line procedures in the field or factory. In addition there are powerful institutional forces slowing the full scale application of labor-saving techniques in this field, including opposition from contractors, and from community and labor interests. On this basis, employment in construction is likely to continue to increase in the nation and region but probably at a somewhat slower pace than increases in population.

D. *The Future of the Core*

Despite trends toward suburbanization the Boston region is still characterized by a very compact pattern of development with most of the population and economic activity concentrated within a ten mile radius of Boston. However, strong centrifugal tendencies in the recent past, including the suburbanization of housing and economic activities, have weakened this pattern. If these recent trends continue, the core which contained almost half the region's population in 1950 will decline to a third of the total by 1980, a trend which would have marked effects on the economy and other aspects of the development of the region. However, if there is sharp growth in popularity of in-town apartments, the core's share of the region's future population may be significantly larger than if the trend toward single family dwellings in suburban locations continues to dominate the regional housing market.

In addition to its attractiveness as a residential area, the future of the core depends in large measure on its attractiveness as a place to work and shop. Centrifugal tendencies in retailing are indicated by the decrease in the proportion of regional retail sales in the Boston CBD, whose share fell from 15% to only 9% of the regional sales total between 1948 and 1958. A similar but less drastic decline was noted for the city of Boston, which decreased from 37% of the region's 1948 total sales to 31% in 1958. If the recent trend (1954-1958) continues, by 1970 Boston may account for only a fifth of the region's retail sales with only a minor fraction of the total in the Boston CBD.

27. See "Automation," *The Annals of the American Academy of Political and Social Science* (March, 1962).

Between 1947 and 1957 the Boston Central Business District experienced sharper employment losses in manufacturing (down 25%) and wholesaling (down 19%). There were some rays of hope, however. During the same decade, finance employment increased by 14% and services employment by 11%[28] Numerically, total job gains in downtown growth sectors amounted to 9,000 of which over 5,000 were derived from finance and insurance.

Employment change in downtown Boston is directly related to transportation patterns. The decline in retailing is largely the result of declines in downtown employees and shoppers entering the CBD. The decline in manufacturing, wholesale and retail activity, accompanied by an increase in finance and service employment, presages an increase in the volume of long-range commuter trips from the suburbs as the ranks of white collar executive and supervisory personnel continue to grow rapidly, however, total downtown trips may decline as the CBD working population diminishes. This growing movement of white collar workers to the CBD is likely to be accompanied by a growing reverse flow of manufacturing employees traveling between core homes and suburban factories.

Employment trends in the core presented in Table 37 have generally paralleled population trends. In the years since 1947, core population declined at an annual rate of 1% annually while employment decreased at the rate of about one-half of one per cent per year. The decline in the core's share of total covered jobs was concentrated in the 11 years 1947-1958. Between 1947 and 1958 the core lost almost 40,000 jobs. The situation changed considerably between 1958 and 1960, however, when core employment increased by about 3,000.

Core area losses have been concentrated in the city of Boston. In 1947, Boston contained 2.5 times as many covered jobs as the remainder of the core. By 1960 the ratio had declined to a position of comparative equality

28. GBESC, *A Report on Downtown Boston* (May, 1959).

TABLE 37

EMPLOYMENT AND EMPLOYMENT CHANGES BY MAJOR CATEGORIES IN THE CORE COMMUNITIES OF THE BOSTON METROPOLITAN REGION, 1947-1958 and 1958-1960.[1]

	Employment (000's)	Numerical Change (000's)		Per Cent Change	
	1960	1947-1958	1958-1960	1947-1958	1958-1960
Total Employment	537.3	—37.9	+3.8	— 6.6 %	+ 0.7%
Construction	31.1	— 2.0	—1.8	— 3.1	— 5.6
Manufacturing	158.5	—32.2	+ .1	—17.3	+ 0.1
Transportation	49.8	+ 2.2	— .8	+ 4.7	— 1.6
Trade	163.6	—18.5	— .3	—10.0	— 0.2
Finance	61.8	+ 9.5	+1.4	+18.8	+ 2.3
Service	72.5	+ 5.9	+5.3	+ 9.5	+ 7.9
Core Minus Boston					
Total Employment	165.8	+ .03	+6.7	+ 0.04	+ 4.2
Construction	13.1	+ 1.6	— .37	+14.7	— 2.8
Manufacturing	71.3	— 6.3	+2.4	— 8.4	+ 3.5
Transportation	11.5	— .64	+ .37	— 5.5	+ 3.3
Trade	42.6	— 1.5	+1.7	— 3.6	+ 4.1
Finance	8.3	+ 3.2	+ .62	+69.2	+ 8.0
Service	19.0	+ 2.7	+2.1	+19.7	+12.1
Boston					
Total Employment	371.5	—37.9	—3.0	— 9.3	— 0.8
Construction	18.0	— 3.6	—1.5	—17.1	— 7.5
Manufacturing	87.2	—25.9	—2.3	—23.3	— 2.6
Transportation	38.3	+ 2.9	—1.2	+ 8.1	— 3.1
Trade	120.9	—17.0	—2.0	—11.9	— 1.6
Finance	53.5	+ 6.3	+ .8	+13.7	+ 1.4
Service	53 5	+ 3.3	+3.2	+ 6.7	+ 6.4

1. In 1958 there was a change in SIC classification. The 1947-1958 changes are based on the old classification, the 1958-1960 changes on the new classification. In 1947 both Boston and Brookline were subtracted from the total. Core communities include: Boston, Brookline, Medford, Somerville, Chelsea, Winthrop, Revere, Malden, Melrose, Everett, Cambridge, Wakefield, Arlington, Belmont, Newton, Watertown.

Source: Massachusetts Division of Employment Security, data for employment covered by employment security program.

with the remainder of the core. Expressed as a proportion of total regional employment, Boston's share diminished sharply between 1947 and 1958 but leveled off between 1958 and 1960. In both periods Boston's major losses were caused by decreases in manufacturing jobs; the city's decline in manufacturing jobs between 1947 and 1960 was accountable for two-thirds of its job losses.

As the region's center for financial, insurance and business services activity, Boston added almost 14,000 new jobs in these two categories in the period 1947-1960. This sizable gain was sufficient, however, to compensate only for about a fourth of job losses in other categories, including a 28,000 decline in manufacturing jobs, a 19,000 loss in the trade category and a 5,000 loss in construction employment. By 1960 finance and services provided more jobs in Boston than did manufacturing industry.

The core area minus Boston experienced employment trends which differed radically from those of the central city. Gains and losses in the remainder of the core were in balance in the 1947-1958 period and there was a minor overall gain in total covered jobs between 1958 and 1960. The primary reason for the recent improvement was a turn-around in the manufacturing trend. Moreover, the core-minus-Boston area gained about half as many jobs over the 13 years 1947-1960 as did the city in the finance and service growth categories, indicating that downtown Boston is no longer the sole geographic location for these activities.

Job gains were concentrated in a narrow geographic compass. Growth was centered in Newton, a town which demonstrates many of the characteristics of a Route 128 community despite its common border with Boston and its inclusion in the MTA district. Over the years 1947-1960 Newton gained 11,000 jobs, 5,600 of them in manufacturing. Without Newton to buoy the economy, the core-minus-Boston area would have sustained a minor loss in non-manufacturing and a sizable loss in manufacturing during the period 1947-1960. Employment trends in some of the municipalities in the core area show a closer resemblance to those of Boston, particularly with respect to manufacturing, than they do to a growth community like Newton.

On the basis of recent trends, it appears likely that the core will continue to be the region's major employment center. A continuation of 1958-1960 employment trends through 1970 would still leave the core with well over a third of the region's total employment, with the City of Boston supplying between a fifth and a fourth of regional jobs. This implies that Boston and the core will remain a job surplus area, recruiting employees from the suburbs. Thus, there will continue to be a strong need for an effective radial transportation system to carry workers from the suburbs to Boston and the remainder of the core, as well as a large potential market for mass transportation for the journey-to-work of core residents.

6. TAX PATTERNS

Complaints about the levels of taxation have been a feature of organized societies throughout most of history. Within Massachusetts, attacks on the fiscal system have mounted in volume in recent years partly as a by-product of political partisanship, but even more as a consequence of justified concern over an obsolete, inequitable system badly in need of major reforms. Much of the attention has focused on local property taxes because, as stated in a report by the Greater Boston Economic Study Committee:

> "Property taxes per capita in this state are higher than they are in any other state in the nation. They are uneven in the burdens they impose on the cities and towns of the Commonwealth . . . (They) . . . pose a threat to the steady flow of new investment into the state . . . The crux of the problem is that local government in Massachusetts bear a much greater responsibility for providing government service and for spending than do local governments in most other states. As property taxes are still the main source of local government revenue, expenditure increases in Massachusetts therefore generate disproportionately large increases in the burden of this tax."[29]

The most serious problems engendered by the pattern of state-local fiscal relations in Massachusetts are concentrated in some built-up communities and, to a lesser extent, in a number of rapidly expanding suburban towns. Since high tax communities contain a minority of the state's population, it has been difficult to marshal wide support for tax reform. All told, there appear to be only 11 high tax communities out of 144 communities in the Boston Metropolitan Region which contain 1.1 million people, or about a third of the region's population. The tax problems faced by different regional communities can be summarized as follows.[30]

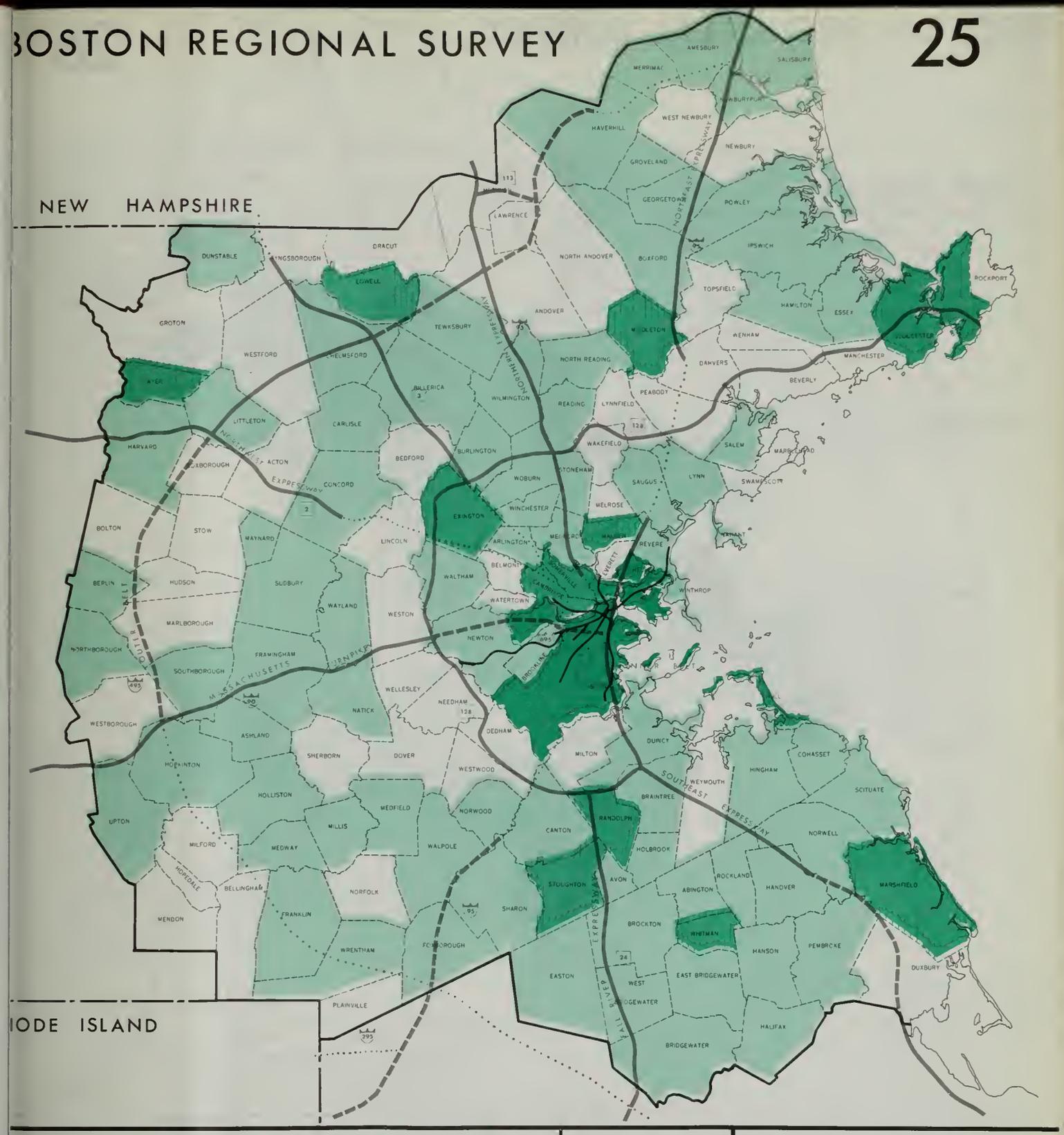
A. *Central Cities*

Boston and Chelsea have far and away the highest levels of real tax rates in the region.[31] Three other core communities, Cambridge, Somerville and Malden, also have extremely high tax rates. The problem in each case is a tax base which has either been shrinking or else not expanding rapidly enough to meet growing needs. The most widely discussed problems are those of the City of Boston where total assessed valuation

29. GBESC, *Financing Local Government in the* 1960's May, 1961.
30. The discussion of tax rates in this section is based on equalized, rather than nominal, tax rates. Because the requirement that all communities assess at 100% of fair market value is more honored in the breach than the observance, published tax rates bear little resemblance to reality. Figure 25 presents data on local tax rates on an equalized basis; however, it should be recognized that the data used to prepare the figure is subject to doubt, and ignores another major problem of local tax policy: in many communities, assessment ratios vary among different types of property and even among the same types of property within a single community.
31. Compiled by Cabot, Cabot and Forbes Co. from Massachusetts Taxpayer's Federation data, *Boston Sunday Herald*, February 4, 1962.

BOSTON REGIONAL SURVEY

25



EQUALIZED TAX RATES, 1961

- UNDER $26.00/$1000 OF VALUATION
- $26.00 – $37.00
- $37.00 – $47.00
- OVER $47.00

SOURCE: MASS. TAXPAYERS' FEDERATION

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
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- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

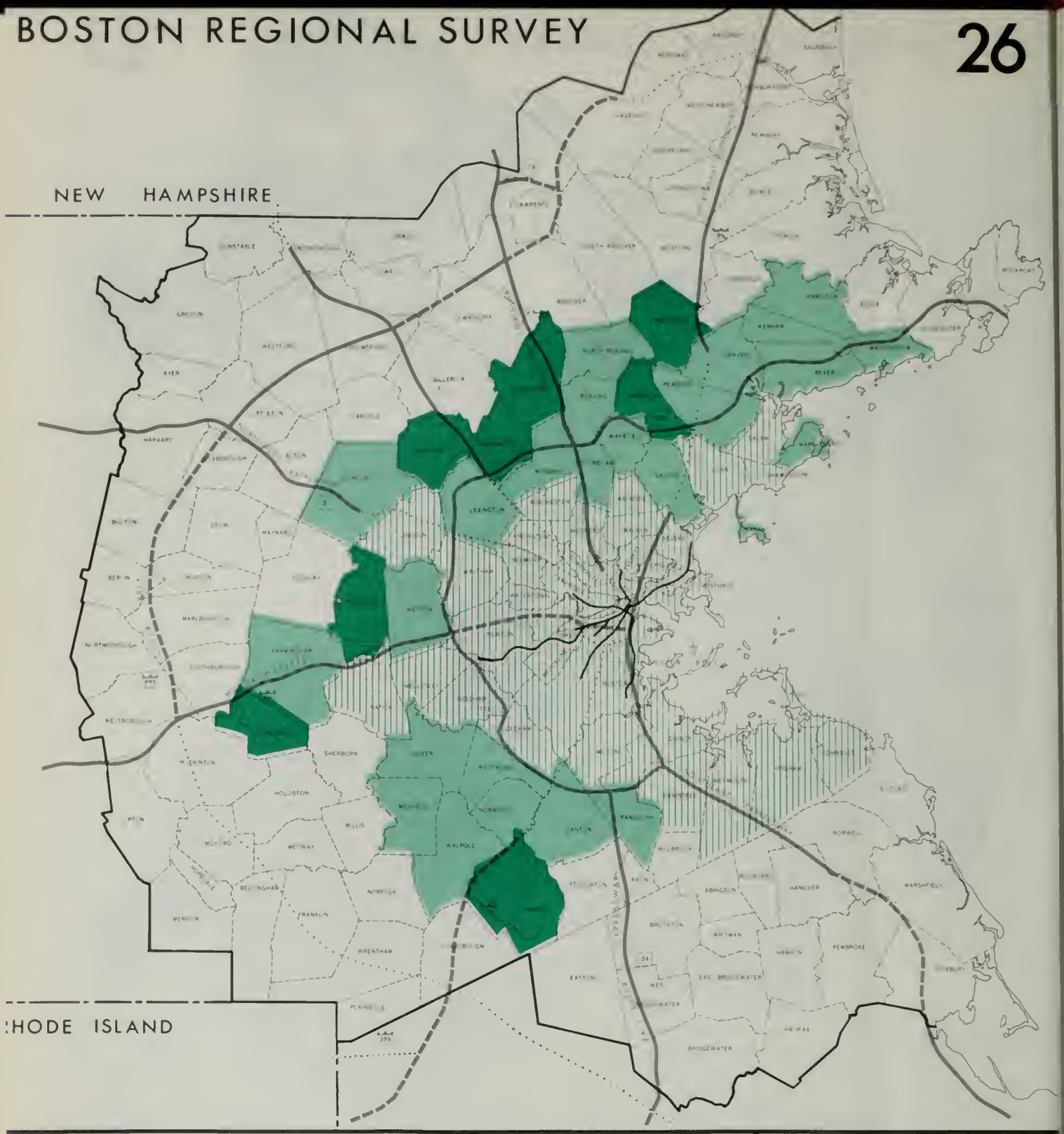
2560 ACRES = 1 SQUARE MILES

0 5 10 MILES

EPARED FOR THE MASS TRANSPORTATION COMMISSION
BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

BOSTON REGIONAL SURVEY



PROJECTED CHANGE IN PROPERTY TAXES, 1958 – 1970

- OVER 150% INCREASE
- 75 – 149% INCREASE
- 0 – 74% INCREASE

} CHANGE IN TOTAL PROPERTY TAX LEVY

- NO INFORMATION

SOURCE: GBESC, FINANCING LOCAL GOVERNMENT IN THE 1960'S

GENERAL INFORMATION

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- SECONDARY HIGHWAYS
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NORTH

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declined by over $500 million or about 25% between its 1930 peak and 1959.

In addition to the high tax core communities some urban communities in outlying areas are also faced with serious tax problems. In Lowell, Ayer and Gloucester, a declining tax base has proven inadequate to meet increased municipal needs without imposition of high property taxes. Even in the region's high tax communities, however, many property owners are not heavily taxed. Some high value core area housing, for example, and particularly older dwellings in established neighborhoods, are assessed at an extremely modest percentage of true value. Owners of such dwellings may actually pay less in taxes than owners of new suburban dwellings. In contrast, downtown commercial property frequently is taxed at a high percentage of its true value.

B. *Fast Growing Suburbs*

In some of the region's rapidly expanding suburbs an influx of large numbers of low income families has not been counterbalanced by a proportionate expansion of property which produces revenue surpluses. This is true of communities like Hull where conversion of seasonal housing to year-round use has turned revenue-surplus producing property into tax deficit units and in suburban towns such as Randolph and Whitman where construction of large amounts of low cost housing has not been accompanied by sizable inputs of either higher cost housing or by substantial industrial or commercial development.

Three types of communities in the region, comprising over 90% of the municipalities and two thirds of the population, enjoy low-to-moderate property taxes. About 500,000 people, roughly one seventh of the region's total population, reside in communities with extremely low tax rates.

C. *Stable Core Communities*

A number of built-up core communities have evolved a stable relationship between the tax needs of a slow growing population, a substantial residential, and in some cases, industrial and commercial, tax base, and municipal expenditures. Such communities include Belmont, Watertown, and Everett in the low tax rate category, and Brookline, Newton, Arlington, Medford, and Winchester in the moderately low tax bracket. A number of urbanized communities outside the core also fall into this stable classification, including Brockton, Lawrence, Haverhill, Framingham, Quincy, Weymouth, Braintree, Revere, Lynn, Salem, and Saugus. Tax rates have been rising in all of these communities, but the pace of increase has been moderate and the total tax burden is still on the low side.

D. *Low Tax Suburban Communities*

A number of communities which contain large amounts of open land (some of which have experienced substantial increases in population in recent years) still enjoy low tax rates. Communities in this category include Duxbury and Rockport, where considerable recreation property adds to the tax base. Lincoln, Weston and Sherborn, where large lot zoning tends to limit residential development to more expensive housing while at the same time eliminating the necessity for expensive municipal sewerage systems, are prototypes for a number of towns in this classification. There are also a number of outlying semi-rural communities such as Groton and Boxborough, in which taxes are low because they have yet to experience the full impact of suburbanization.

E. *Balanced Suburbs*

The last group consists of suburban communities which have successfully balanced residential expansion with major increases in their industrial and commercial tax base. Communities of this type include suburbs near Route 128 which have provided sites for industrial parks such as Needham, Dedham, Bedford, and Westwood. Other communities in this category include Andover and North Andover in the Lawrence area, and Lynnfield and Peabody (site of the North Shore Shopping Center) near Boston.

Three additional observations are in order concerning property taxes in the region. The first concerns the rate of increase. The GBESC study of 65 Greater Boston area communities concluded that the rate of increase in the period 1958-1970 property taxes will be somewhat less than in the 1949-1958 period, assuming that the present pattern of state-local fiscal tax relationships remain unchanged through 1970. Moreover, as Figure 26 indicates, property taxes will probably continue to rise faster in the suburbs than in the city of Boston.

A second point to be considered is the disparities between published tax rates, actual rates, and the differential tax burden imposed on property within communities. Not only is commercial and industrial property more heavily taxed than residential property of the same value but there are frequently substantial differences between taxes imposed on new housing as compared to older residences, as well as between houses in different neighborhoods. Reassessment, one method of uncovering overlooked tax valuation and reducing tax discrimination, has been adopted in some communities. However, a thorough reassessment program is expensive, and frequently it is opposed by taxpayers who fear that it would result in higher taxes on their property as well as by those who believe that any benefit which might be derived from a community reassessment program would not justify its cost.

Although the figures available for comparisons are both crude and tentative, they are sufficiently accurate to draw two conclusions:

(1) Local property taxes are two or three times as burdensome for homeowners and renters in Boston and other high tax communities as they are in many suburbs, and

(2) Property taxes are not a serious problem in most of the region's communities.

Part of the reason for the failure to enact a thoroughgoing reform of the state-local tax structure in Massachusetts can be found in the fact that most taxpayers are not afflicted by local property taxes. In some ways the situation parallels the MTA deficit; a relatively small number of core communities are the most troubled by this problem, while most suburban and outlying communities have not yet been driven to demands for tax reform.

CHAPTER THREE — HIGHWAYS

1. HISTORICAL BACKGROUND

The first highway law in Massachusetts (1639) was modeled after one that had been enacted in Virginia about 17 years earlier, based upon a statute labor system known as "working out the road tax." This law was supplemented by donations, assessments on adjacent properties, fines for failure to perform statute labor, and a variety of other methods aimed at constructing and maintaining the sketchy, primitive highways of 17th century Massachusetts. By 1650 some local governments in New England used the power of local taxation to raise funds for highway construction.

Until the late seventeenth century Massachusetts public roads were mainly horse paths except near population centers, where roads were constructed to carry carts and wagons. Many of the old roads in the region followed the routes of Indian trails.

Prior to the Revolutionary War, England hindered the development of early land transportation routes in the colonies as part of its policy of restricting intercolonial trade. Roads leading from the coast into the interior as well as routes parallel to the coast were in a thoroughly inadequate condition when the Revolutionary War ended.

There was no prospect of corrective action because there were no organizations empowered to build and maintain roads beyond local boundary lines. To remedy this deficiency, private turnpike companies were formed and chartered in Massachusetts by the Commonwealth. The turnpike companies were given the right of eminent domain in constructing these roads with toll rates, the number and the location of gates included in the terms of charter.

Roads constructed by the turnpike companies were to revert to public ownership when investors had been paid back their first investment plus 12%. The expected life of the turnpike corporation was 20 years. However, no turnpike in Massachusetts approached these goals of time and profit. In fact, the Salem Turnpike, the most successful turnpike investment, paid only a 3.1% return over a 60-year period. Some turnpike investors received major rewards from the beneficial effects of the improved roads on local towns and businesses.

One of the stated aims of the turnpike companies was to build roads in a straight line. The twisting alignment of the existing roads was frequently cited by petitioners as the reason for building the new roads. However, in their zeal to adhere to straight alignments many of the turnpike builders neglected to consider the detrimental effects of excessive grades despite general agreement that horses could not efficiently haul wagons at grades steeper than five per cent. Furthermore, in attempting to connect distant cities with straight lines the turnpike builders by-passed population centers that would have added substantially to their traffic volume and revenue.

Vestiges of the turnpike period characterized by straight alignment can be found in the region. These include Washington Street near the Dedham line, the Newburyport Turnpike along most of its length, sections of the Worcester Turnpike, and a four-mile straight section along existing Route 1 from Route 140 in Foxboro to Plainville. Examples closer to Boston include Mystic Avenue, Broadway in Chelsea, Route 107 in Revere, Commonwealth Avenue, Brighton Avenue, North Beacon Street, and part of Route 2 along the Belmont-Arlington line.

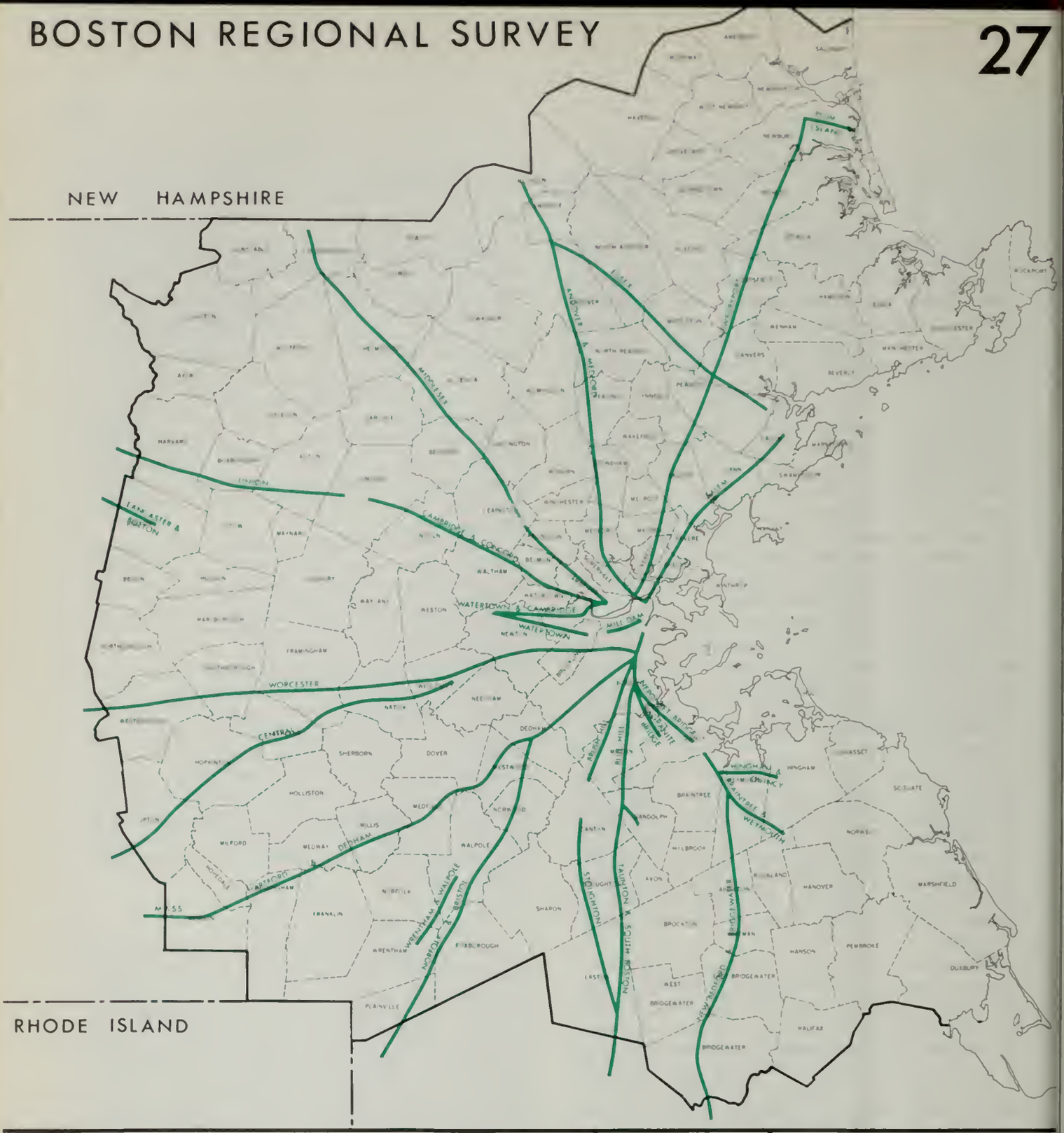
The emphasis on privately owned toll road companies and the advent of the steam railroad, which quickly became the preferred mode of transportation, produced a period during which government aid to road-building was minimized. Through most of the nineteenth century intercity public road construction was at a virtual standstill. As a result, the period between the end of the toll road era (about 1850) and the beginning of a Massachusetts state road-building agency in 1893 was marked by a gradual deterioration of the highway network. This trend was common throughout the nation.

Toward the end of the nineteenth century intercity connections had deteriorated to the point where state governments throughout the country were forced to take on road-building responsibilities. Massachusetts was a leader; it was the second state to organize a state roads department.

A. *The State Highway Department*

A bill establishing a State Highway Commission was approved by the legislature in 1893. The bill provided that proposed roads be petitioned for by County Commissioners and be approved by the State Highway Commission. A separate bill for the construction of each road had to be submitted to the legislature for financing. However, a year later the legislature enlarged the powers of the Commission by allocating to it a sum of $300,000 to be used without further legislative action in constructing state highways. In 1894 the Commission requested petitions from local governmental agencies. A total of 108 petitions were received out of which thirty sections of road were approved and built in various parts of the state. A limit of two miles of improvements per community was established to extend limited funds and to demonstrate to local communities the latest advances in road building techniques. Before the turn of the century the State Highway Commission developed a plan to connect the major cities with high-quality roads. In some instances the roadway width of the state

BOSTON REGIONAL SURVEY



EASTERN MASSACHUSETTS TURNPIKE DEVELOPMENT, 1850

SOURCE TURNPIKES OF NEW ENGLAND

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
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- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
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◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

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highways constructed before 1900 was 18 feet but more often it was only 15 feet. In other cases, single lane, nine-foot roadways were built with frequent double-width sections to permit passage of carriages. By 1899 a total of 250 miles of state highways had been completed.

The general policy of the Highway Commission was to concentrate on rural highways and on the main routes used for travel between the largest cities and towns. Although many of these roads led to the city of Boston, only 3.6 miles of state highway had been laid out within Suffolk County (Boston) by 1915 out of a total of 880 miles of completed state highways.

By 1910 the Highway Commission developed plans for a complete system of state highways. The Commission plan called for linking all major population centers by a network of high quality state-maintained roads. Ultimately construction of intercity roads within the state resulted in routes which traversed the entire state and which connected with highways in adjoining states.

In 1916 the Federal Aid Road Act was passed which provided federal funds for highway construction. The objective was the establishment of a comprehensive system of interstate roads. Massachusetts responded to rapidly increasing demands for improved and expanded highways by adoption of Chapter 350 of the General Acts of 1919. This provided for a Department of Public Works to be in charge of state highway construction among other activities. By 1920 state highway mileage totalled 1,394 miles, a gain of over 50 per cent since 1915. Table 38 shows the amount of new highway mileage built by the DPW between 1920 and 1960. The total mileage in the state highway system at the end of each five year period is also shown. By 1920 most of the state highway system had been laid out. The mileage of construction after 1920 far exceeded additions to the state highway system. This DPW construction has consisted of upgrading existing roads and building new state highways while discontinuing older, by-passed sections of road. In the 1930's the DPW constructed a number of high-quality roads, including the Newburyport Turnpike from Danvers to Newburyport and a 12-mile portion of the Boston-to-Worcester Turnpike from Southborough to Worcester. This section of highway, built of cement concrete and 40 feet wide was a forerunner of the high-quality rural highways built throughout the region during the 1930's.

During World War II (1941-1945) state highway construction and planning was decelerated. Less than a month after the conclusion of the war, however, a study was initiated to make recommendations for comprehensive highway improvements in the Greater Boston Area. This study resulted in a report prepared in 1948 entitled *The Master Highway Plan.* This report proposed a system of radial expressways leading from the city of Boston to suburban communities and leading eventually to other major cities in New England. In addition, two circumferential routes were recommended: (1) an inner loop around the downtown area of Boston, and (2) an outer loop approximately ten miles outside the downtown area. Only a small portion of the Inner Belt has been completed but most of the outer circumferential Route 128 had been completed by 1957.

TABLE 38

STATE ROAD MILEAGE CONSTRUCTION TRENDS IN MASSACHUSETTS 1923-1960

Period	Total Mileage Built by the DPW	Total Mileage in Highway System at end of Period
1923-1925	253	1,542
1926-1930	572	1,624
1931-1935	605	2,107
1936-1940	491	1,890
1941-1945	257	1,917
1946-1950	972	1,988
1951-1955	1,038	2,188
1956-1960	688	2,385

Source: U.S. Department of Commerce, *Highway Statistics, 1955 Summary* and 1956 to 1960 annual volumes (Washington: U.S. Government Printing Office).

At the present time there is considerable expressway construction in the Boston region. In addition to the Interstate projects currently underway, federally aided primary and secondary routes in the region are being improved by the state Department of Public Works. The peak highway construction activity in the region is scheduled to continue well into the mid-1960's with no major decrease in the level of spending expected to occur for at least 10 years.

2. REVIEW OF REGIONAL HIGHWAY STUDIES

Unlike the region's transit and railroad system, the expressway system built, under construction, or proposed for the region has been based on extensive planning studies of highway requirements. During the past 30 years, five major highway studies have been prepared in the Boston region. These are the *Report on a Thoroughfare Plan for Boston* (the Whitten Report) published in 1930 by the Boston City Planning Board; three Department of Public Works studies: the 1948 *Master Highway Plan,* the *Report on Traffic Studies for the Boston Metropolitan Area,* published in 1957, and the *Inner Belt and Expressway System Study* published in 1962; and a study entitled *Travel in the Boston Region 1959-1980,* published in 1958 by the Boston College Seminar Research Bureau.

All of these studies have assumed that a major public transportation component would absorb future peak demands in heavily traveled transportation corridors which could not conceivably be accommodated by highways. However, while the concept of total transportation plan-

ning has long been recognized, no major study has successfully developed a comprehensive plan integrating the various elements of the region's transportation system.

Regional or metropolitan area transportation studies have evolved in the Boston area in much the same way as have advances in highway design. Early studies, made by the city of Boston, included only the city as the area of critical concern but later studies enlarged their sphere to include areas that were considered to be part of the Boston metropolitan area. Figure 28 shows the areas included in the major highway reports. Even the 1930 Whitten report, which was primarily concerned with improvements within Boston, related these improvements to a larger system of metropolitan and state highways and parkways in areas to the north, south and west of Boston.

In addition to the metropolitan surveys, other important traffic studies within the Boston region have been prepared. *A Master Highway Plan for the Lowell-Lawrence-Haverhill Area,* prepared in 1956 by the State Department of Public Works, has formed the basis for highway improvements in the Merrimac Valley that are now either completed or in various stages of construction or design. In 1954 the Boston Traffic Commission conducted a cordon count around the downtown area. This study was designed for inventory purposes only, to be used in comparison with earlier cordon counts made in 1927, 1932, 1938 and 1950, and did not include any analysis or recommendations. Other studies of specific problems have been made throughout the region dealing with local problems and specific projects. These include various expressway traffic analyses, socio-economic and highway impact studies, and traffic circulation and parking studies for individual communities.

In order to trace the development of the regional highway system and to gain an insight into the various factors shaping this system, five major studies are reviewed here. The review of each report is divided into four subsections: general aspects, traffic analysis and forecast, major proposals and summary.

A. *Report on a Thoroughfare Plan for Boston, 1930 (Whitten Report)*

a. *General*

The technique of traffic analysis and the organization and methods used in the preparation of this report characterize it as a significant step in the development of metropolitan area transportation studies. Traffic assignment methods used to estimate traffic volumes on proposed facilities are valid even today and many recent traffic studies throughout the country show a marked similarity to this traffic analysis method. The Whitten report was one of the first studies to use travel time analysis as a measure of highway service.

This report assumed a major reliance upon public transportation for peak travel hours. Continued public acceptance of the mass transit system was the basis for the report's recommendation that the rapid transit system be extended outward to reduce Boston's rush-hour street traffic. The report also assumed that an expansion of street and highway capacity to accommodate rising off-peak traffic volumes would not necessarily result in further traffic volume increases which would again congest the system. In this respect the report was unrealistic. For example, the recently completed Southeast Expressway, Central Artery and Storrow Drive have experienced peak-hour congestion since they were opened to traffic.

b. *Traffic Analysis and Forecast*

A comprehensive origin-destination survey in the area using 178 roadside interviewing stations was the basis for the projections and recommendations. A total of 188,000 interviews were conducted, over half within the city of Boston, along with surveys of traffic volumes and travel time.

Statistical analysis to expand the 1927 traffic data to future years was based exclusively on projected population growth and the trend in the persons-per-vehicle ratio for study districts. The report projected traffic data for a 35-year period extending to 1965.

The Whitten report's forecasts of population and vehicle registration for 1965 were high. The population projection for the 39 cities and towns in Metropolitan Boston was overestimated by 33%; motor vehicle registrations were only 8% above actual 1960 figures. The more accurate vehicle registration figure resulted from an assumed persons-per-vehicle ratio of 4.22 which proved to be high; however, this error was compensated for by the erroneous population projection.

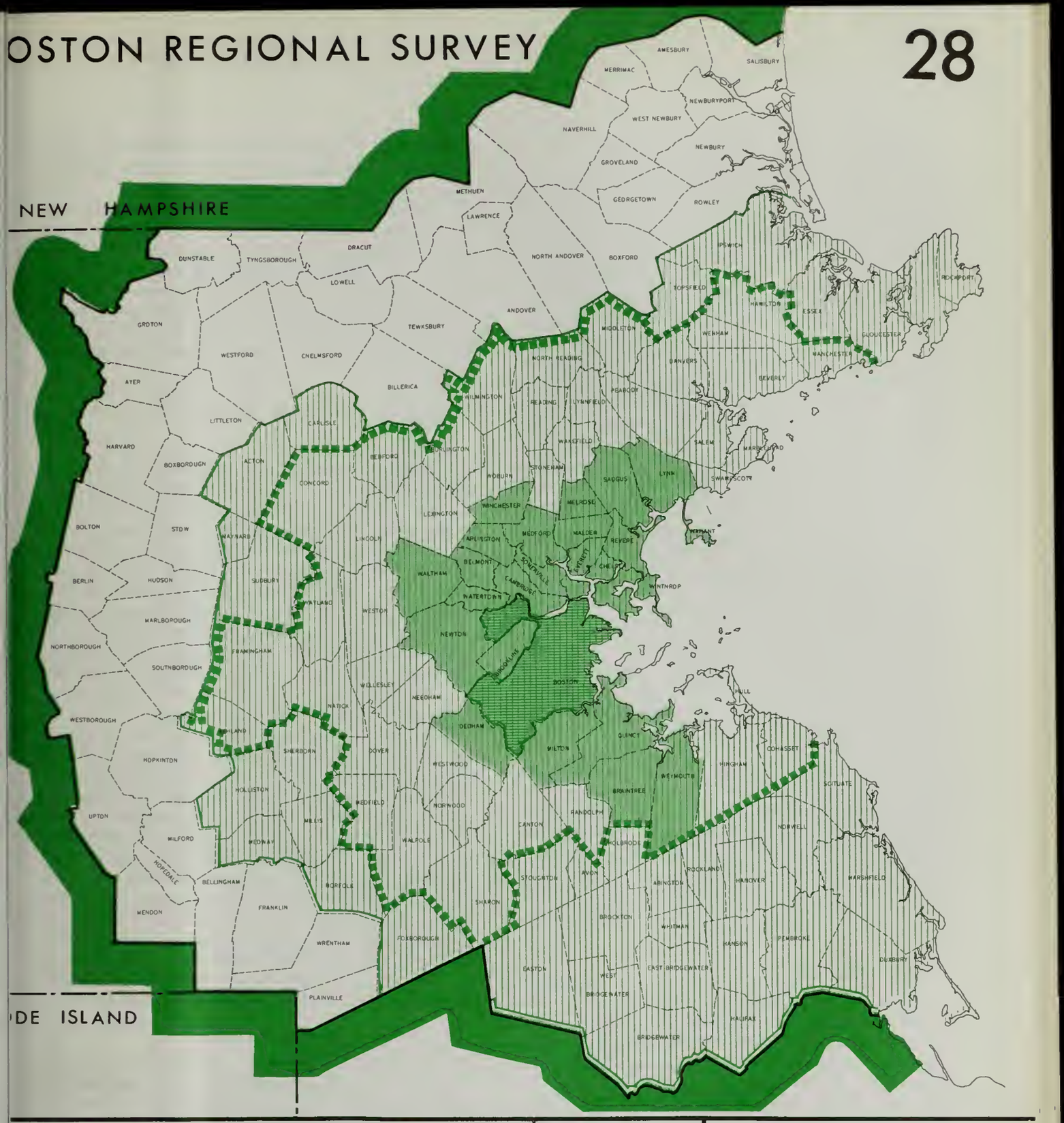
The persons-per-vehicle ratio was expected to level off to a minimum of 4.22 persons-per-vehicle after 1945. It is ironic that 1945 was to mark the beginning of an increase in automobile registrations so tremendous that even projections made at the time in the 1948 Master Highway Plan fell short of actuality. Actually the 1960 persons-per-vehicle ratio was 3.43 in the study area.

The 35-year forecast period of the Whitten report was unusual in terms of its length. Many recent traffic reports have used 20 years as a target date to test the feasibility of constructing new facilities and some have used time periods as short as 15 years. The report's major proposals, however, were based upon the area's short term needs.

In addition to the fact that this report proved high in its long-term projections of population and automobile registrations, the report failed to take into consideration future changes in the land use or population and economic composition of the metropolitan area. However, despite these shortcomings in forecasting technique and projections, the analysis of the basic origin-destination data was excellent and provided the necessary background to develop a valid arterial system to serve existing and future traffic volumes.

OSTON REGIONAL SURVEY

28



STUDY AREAS OF MAJOR HIGHWAYS REPORTS

- 1930 WHITTEN REPORT
- 1948 MASTER HIGHWAY PLAN
- 1958 B.C. SEMINAR STUDY
- 1962 INNER BELT STUDY
- BOSTON REGIONAL SURVEY

RED FOR THE MASS TRANSPORTATION COMMISSION

THE PLANNING SERVICES GROUP, CONSULTANTS

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

c. *Major Proposals and Recommendations*

Many of the proposed traffic improvements in this report have been built and have become key facilities in the region's current traffic system. Although some of the proposals were not carried out until recently, they were built in much the same manner and location as recommended in this report. One primary recommendation of the report which showed great foresight was the construction of a four-lane tunnel to East Boston. Construction of the Sumner Tunnel had been authorized by the legislature and accepted by the city of Boston while the study was in progress. The Whitten report pointed out that the 16 million authorization was not sufficient to build a four-lane facility and that additional money should have been allocated for this purpose. The report estimated that the two-lane tunnel would reach capacity volume in 1934, soon after its opening. For this reason construction of an additional two-lane tunnel was recommended.

A Central Artery was proposed for very much the same location as it was finally built to serve traffic in the manner originally conceived. The Central Artery was recommended as a two-level facility with the upper roadway for express travel and the surface roadway serving as a local access and feeder street. It is remarkably similar to other facilities which have been designed in recent years in Boston and other cities, again emphasizing the advanced traffic and engineering concepts displayed throughout the report.

Of special interest was a proposed Roxbury cross-town highway to connect the arterial routes in the southeast and southwest sector and to provide a facility for cross-town movement indicated by the origin-destination study. While the principle of a belt route was not defined nor explicitly recommended, this proposed facility would have performed such a function. The proposed location of the cross-town route is similar to the location of the highway proposed in the recent Inner Belt study.

d. *Summary*

Although highway usage has far exceeded the projections of the Whitten report, many of its recommendations are still valid today. The report's main deficiencies arise from the fact that the criteria recommended for highway improvements were not adequately related to future travel desires, particularly the needs of a suburban-oriented population. In addition, proposals for improvements within the downtown area of Boston were based on vehicle traffic, and did not assume a shift in mode of transit riders. As a result, the 1927 study of origin and destination provided an excellent analysis of the demands of vehicles, but gave too little attention to the requirements and future role of rapid transit.

The Whitten report based its recommended highway improvements on the assumptions that (1) highways were needed to accommodate all traffic that could not conveniently or economically use railroads or rapid transit lines, and therefore, (2) a good highway system was necessary for the economy of the region.

Although the report was correct in its judgment that the recommended expressway and parkway system would be of immense benefit to the city of Boston, it failed to recognize that the recommended highway system if constructed, would help to undermine the financial stability of the public transit system. Furthermore, the Whitten study assumed that long-term relief for traffic congestion could be achieved by providing additional highway facilities.

B. *The Master Highway Plan of 1948*

a. *General*

This report, sponsored by a joint board consisting of the State Department of Public Works, the State Planning Board and the Metropolitan District Commission, incorporated the most extensive field study made to date in the Boston area and is the primary basis for the expressway system within Route 128. This study was prepared before funds for highway improvements became available in an unprecedented amount through the Federal Highway Act of 1956 (the Interstate Program). When the need for an expressway system became acute and when federal funds became available for construction, the Boston area was prepared with a sound plan for extensive highway construction.

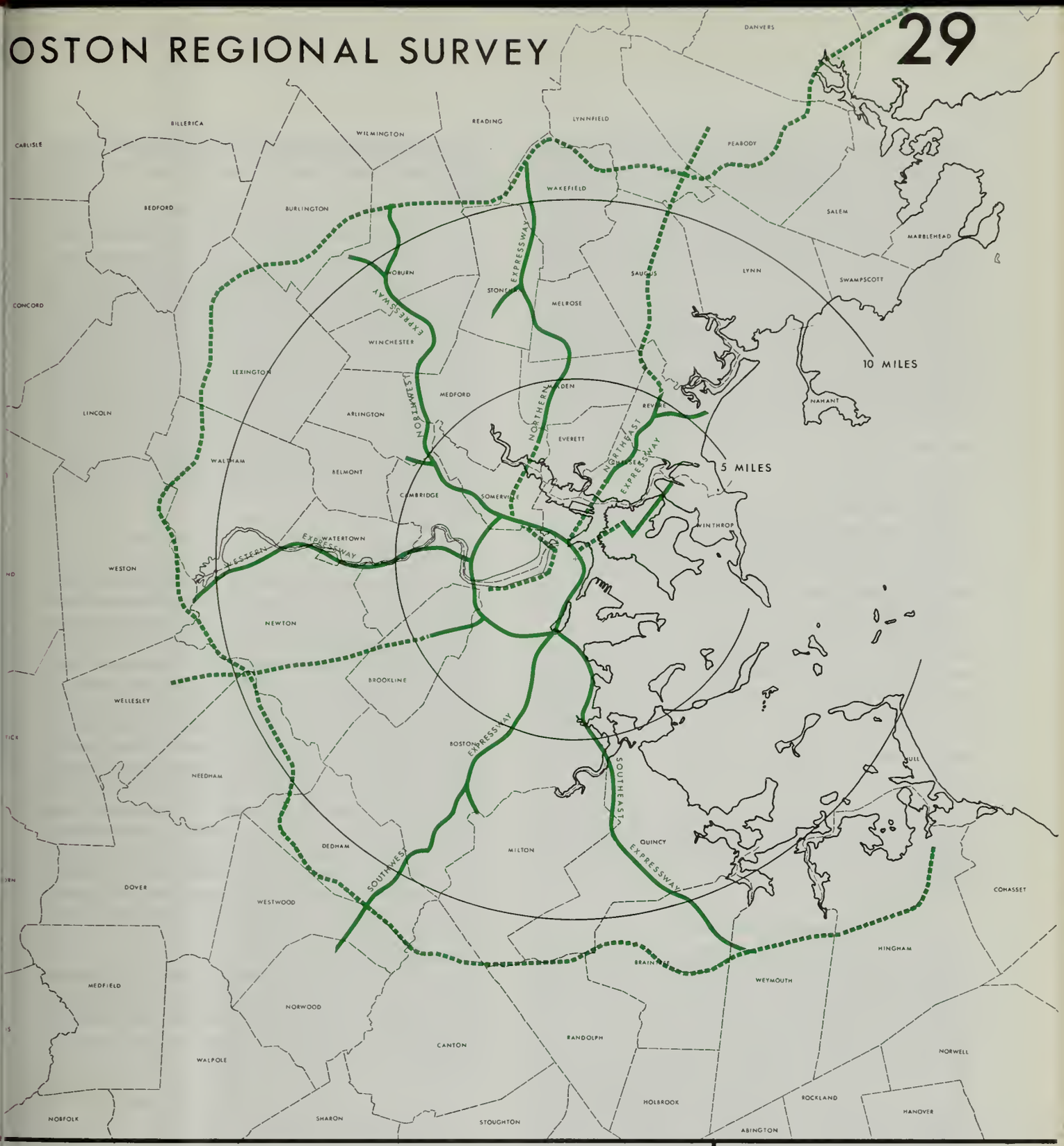
The field study for the survey was carried on during the autumn of 1945, immediately after the end of the war. Conducted shortly after the gasoline rationing was terminated, the survey found that mass transportation trips outnumbered trips by private automobile. There were 979,000 mass transportation trips in the study area as compared to only 812,000 vehicle trips. The shortage of gasoline and tires as well as the cessation of private automobile production during the war accounted for this transitory pattern. In consequence, the 1948 Master Plan, like other plans based on surveys made immediately after the war, tends to be seriously distorted in the direction of overestimating public transportation volumes and underestimating private vehicle use.

b. *Traffic Analysis and Forecast*

Data for the traffic survey was obtained from two sources: home interviews within the study area bounded by Route 128 as it exists today, and driver interviews for vehicles at the cordon lines. A 5% sample was used for the home interviews resulting in a total of 22,500 interviews. A 10% sample of trucks and taxis was also taken. At the cordon line nearly 60% of all vehicles (approximately 111,000) crossing into the study area were stopped and their drivers interviewed.

This was the first time the home interview method of obtaining origin-destination data was used in the Boston area. The techniques used in this report were standard for the period. Mass transportation trip infor-

OSTON REGIONAL SURVEY



THE 1948 MASTER HIGHWAY PLAN

— PROPOSED EXPRESSWAYS

..... PROPOSED ADJUNCTS TO EXPRESSWAYS

SOURCE: 1948 MASTER HIGHWAY PLAN

NORTH

1 SQUARE MILES

0 1 2 3 4 5 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954 AS AMENDED

mation was obtained from the home interviews. Since no mass transportation data was secured from persons crossing the cordon line no information was obtained on railroad commuters entering from outside the cordon. These long-distance railroad trips probably would not have had major significance for the highway plan since this study preceded the era of large scale suburbanization.

Specific attention was given to downtown area traffic. It was found that the heaviest movement into the downtown area came from the west and the lightest movement from the north. The study found that 25.5 per cent of all traffic movement (202,000 trips) within the cordon (Route 128) occurred within the downtown area and that only a sixth (27,700) of the total traffic entering the downtown area could have by-passed the Central Business District.

The report estimated that between 1945 and 1970 traffic in the study area would increase by 77 per cent in core areas and 135 per cent in fast growing suburban sub-areas. However, within five years it became clear that these projections underestimated actual increases in automobile usage.

The 1945 to 1970 traffic projection was based on a combination of population increase, vehicular ownership, and an increase in vehicular usage. The study projections proved to be low with respect to population and ownership but high with respect to the projected increase in vehicular usage. The sharp rise in annual mileage from 7,771 miles per vehicle in 1945 to 9,947 in 1946 was not repeated; in fact annual mileage had not reached the 1946 level in the past sixteen years.[1] Also, although the report took into consideration such items as shifts in population and changes in the person-per-vehicle ratio, the extent of these changes was underestimated.

c. *Major Proposals and Recommendations*

The Master Highway Plan proposed a system of arterial expressways joined at the hub by an inner belt route. Another belt route (Route 128) already under construction was proposed for early completion. Figure 29 shows the major recommendations of this report. The names given to individual expressway routes in this report have, for the most part, been retained and thus are easy to identify. In addition to the proposed expressways, sixty-one improvements to existing streets and highways were recommended including many in the downtown area of Boston.

Generalized parking recommendations in the report suggested that Boston and other cities prepare long-range parking plans. The report cited a study by the Boston Planning Board to guide the expenditure of $5 million for parking sites and structures. (Some years later, however, construction of a single major facility which did not necessitate any expenditures for land-taking, the Boston Common Garage, cost almost $10 million.)

In the tradition of highway studies the Master Highway plan contained a section on public transportation entitled "Coordination With Transit Improvements." Among the items touched upon was the possible use of express buses on the expressways system, particularly over the Mystic River Bridge and the Southeast Expressway. All intercity buses were expected to use the Central Artery. Several bus terminals were planned for the downtown area. The report suggested use of consolidated rights-of-way for both highway and rail facilities although it made no specific recommendation. Although none of these recommendations were adopted, there has been recent interest in permitting bus service on expressways and in providing joint rights-of-way for highway and rail facilities.

d. *Summary*

The Master Highway Plan of 1948 forms the basis for the Boston area expressway system. Prepared immediately before a tremendous increase in vehicle registration and usage, the plan became the official program for meeting the vehicular problems of the region. Implementation was greatly assisted by the enactment of the interstate Highway Program that was to give tremendous nationwide impetus to expressway construction.

Unfortunately, this report, like the Whitten report failed to foresee the aproaching decline in mass transportation patronage. Traffic volumes were underestimated and mass transit overestimated because no consideration was given to shifts in mode of transportation. The 1948 Master Highway Plan assumed construction of the transit extensions recommended in the Coolidge Commission Report of 1947, indicating that the recommended expressway system would be inadequate to handle future traffic volumes unless these transit improvements were made.

Future transportation reports are likely to alter or revise rather than supersede the 1948 Master Highway Plan. Progress in implementing the Plan has thoroughly committed the area to the basic concept of expressways as proposed in the 1948 report.

C. *Report on Traffic Study for the Boston Metropolitan Area, 1957*

a. *General*

This report consists of three separate sections: Section A deals with the extension of the Massachusetts Turnpike into Boston; Section B is essentially a review of the Master Highway Plan of 1948; and Section C analyzes the feasibility of providing an additional harbor crossing and its impact on the expressway system.

In general, the entire report has not received the wide attention of the major traffic studies of 1930 and 1948,

1. *Facts and Figures*, Automobile Manufacturers Association, (Detroit, 1961).

partly because it did not receive wide distribution, and also because it made no new major transportation proposals.

b. *Traffic Analysis and Forecast*

The major field effort was an origin-destination survey using stations along Route 128 to form a cordon around the metropolitan area. Many stations were in the same location as those for the 1948 study, making it easy to up-date some of the earlier data. The origin-destination data was gathered by driver interviews, a technique similar to that of earlier reports. No information was obtained for trips with origins and destinations within the cordon area, except at a harbor crossing screen line to test any new harbor crossing facilities.

While trips passing through the cordon could be updated easily, the problem of updating internal trips within the Route 128 cordon was more difficult. Trips within the cordon were projected on the basis of the expanded volume through the cordon line, Route 128. Between the 1945 and 1955 surveys, however, the suburban explosion had taken place. Consequently the number of trips crossing Route 128 increased at a much greater rate during the ten year period than had trips between places within the cordon line, i.e., internal trips. The net result of expanding internal trips on the basis of changes in cordon line crossing was an overestimation of the number of internal trips.

The report anticipated that during the period from 1955-1975 the normal traffic growth of the metropolitan area would be about 81% or about 3% per year compounded annually. It was expected that new high speed facilities would generate a demand over and above normal traffic growth. This factor was estimated to be 45% of the traffic expected to use the expressways. Between 1955 and 1975 traffic on the expressway system was expected to increase by 160%.

This report assigned traffic to the various expressways without regard to the anticipated capacity of the proposed facilities with the result that in some traffic corridors the 1975 estimated traffic volumes were clearly beyond highway capacity. For example, a section of the Southeast Expressway near the Inner Belt showed a 1975 assignment of 270,000 vehicles per average day, about three times its potential capacity.

c. *Major Proposals and Recommendations*

In general the *Report on Traffic Study for the Boston Metropolitan Area* lent further support to the Master Highway Plan of 1948 with regard to the need for and location of the various expressways. However, it pointed out that the traffic estimates for 1970, on which the Master Highway Plan of 1948 was based, had already been exceeded by 1957. While the study recognized the unanticipated and unprecedented growth of traffic following the 1945 study, it did not offer any solution to the problem of demand other than to suggest that excess volumes of a short run nature would have to be absorbed by the arterial street system.

There was one new element in this report, namely the recommendation for a Massachusetts Turnpike extension to connect with the Central Artery near the South Station. In contrast, the 1948 plan had recommended construction of a western expressway which was to terminate at the Inner Belt.

This report was the first to assign traffic to the Sumner Tunnel, with the result that the need for a second tube was made clear. Moreover, it estimated that by 1972 another harbor crossing in addition to the Sumner and Callahan Tunnels and the Mystic River Bridge would be needed.

d. *Summary*

The *Report on Traffic Study for the Boston Metropolitan Area, 1957* has not been the basis for the construction of major traffic facilities. However, it did provide a review and updating of the Master Highway Plan of 1948. The value of the report was limited by its failure to consider the public transportation system, particularly the future of rapid transit. This omission is surprising in view of the large amounts of traffic that the study assigned to the Central Business District and to the sharp drop in mass transit ridership which had occurred by 1957.

D. *Travel in the Boston Region, 1959-1980*

a. *General*

Prepared by the Boston College Seminar Research Bureau in 1958 this report is unique in certain respects. It is the only study of the five discussed in this chapter that was not prepared by a government agency. It is the first study in the region that has not been based on a large amount of field-collected statistical data, but relied instead on the gravity model technique of travel analysis. This technique involves use of complicated formulae based upon previously determined relationship between land use, economics and transportation. This was also the first of the region's traffic studies to analyze traffic patterns outside Route 128; the boundary of the study area extended in an arc generally one tier of communities inside the Outer Belt.

In addition, the Boston College report recognized the concept of studying total trips generated and assigned these trips to various modes. Previous studies assigned traffic to the highway system and did not consider mass transit trips. Furthermore, previous studies did not consider changes in trip patterns which might result from changes in land use.

b. *Traffic Analysis and Forecast*

The information for the study was based on a 0.12% sample; 1,000 out of 825,000 families in the study area

were interviewed. Four factors were used as the basis for predicting future travel requirements: (1) 1959 and 1980 population and its distribution, (2) estimated size and distribution of employment, (3) car ownership characteristics and (4) measures of travel time. These factors were used as inputs to develop the gravity model equations.

The report forecast a minimum of 650,000 person-trips for downtown Boston by 1980. It was estimated that the modal split in 1980 will be similar to 1959: 37% of persons entering the CBD will use mass transit and 63% will use automobiles. The report estimated that an additional 10,000 off-street parking spaces over and above those existing in 1959 will be needed in 1980 to accommodate short-term parkers in the downtown area.

c. *Major Proposals and Recommendations*

The study supported the findings of the Master Highway Plan of 1948 but recommended some additional improvements. Top priority was recommended for the Inner Belt, and construction of expressway elements within the Inner Belt as suggested in prior studies. New suggestions included the construction of Route 2 as an expressway. The highway recommendation for which the report is perhaps best known however, is that an Intermediate Belt route be constructed in an arc with a radius of about five miles from the center of Boston. The study suggested that this route would relieve congestion on Route 128 and the Inner Belt. However, no specific route was recommended since the study was not designed to make recommendations for the location of routes or interchanges but was limited to study major travel desire corridors.

d. *Summary*

The fact that this report was undertaken independently by a university and that the gravity model technique was used makes the study unusual for the Boston area. In addition, it is the first regional study to consider seriously both highway and rapid transit needs as part of an overall transportation system.

However, because of the very limited sample used and the fact that the gravity model approach is still in the experimental stage, the study does not provide a strong foundation for proceeding with specific capital improvements. Therefore, while general findings and overall estimates of travel requirements may be valid, it would be imprudent to commit major outlays of highway or transit construction funds solely on the basis of the research findings and recommendations contained in the Boston College Study.

E. *Inner Belt and Expressway System, 1962*

a. *General*

This report, published in the summer of 1962, was concerned primarily with the segments of the region's highway system within Route 128 that had been recommended in earlier reports. (See Figure 29.) A total of 65 communities were included in this traffic study area and 121 in the socio-economic study area (see Figure 28). This is the first major State Department of Public Works traffic study to rely on the model technique for the assignment of traffic to the expressway system. Also it is the first study to use an extensive socio-economic analysis in a traffic report; the data from such an analysis are essential to te mathematical model technique used in the report.

One of the most significant aspects of this report is the extreme detail in which the various routes were studied. These details for each recommended an alternate location and were grouped into two general categories: (1) physical effects and (2) project costs. Physical effects included the number and use of structures that would be affected, and displacement of householders and employees. These items were studied by individual cities and towns. Project costs included acquisition of right-of-way at fair market values. A separate road-user benefit analysis was also made for each section of the expressway system.

The report has aroused wide interest in the Boston area for at least three reasons. (1) Construction of the recommended expressways would involve traversing the most densely populated portions of the region and would create substantial dislocation. (2) Construction of the projects recommended will require an expenditure of $325 million over a proposed 10-year construction period. (3) Tremendous benefits to the Boston area would result from the completion of the expressway system.

b. *Traffic Analysis and Forecast*

A decision was made to use the gravity model technique for traffic analysis after an exhaustive review of available data from previous reports revealed that the information that had been collected earlier could not be used effectively in an empirical traffic projection and analysis. Furthermore, the socio-economic and land use information needed in the analysis of the various routes could be utilized as the input for the gravity model. (The term "gravity" refers to the fact that these models are based on relationships that resemble the physical law of gravity. Bodies exert a force on each other proportional to their mass and inversely proportional as the square of the distance between them. The attraction between centers of population and retail and industrial centers have been measured and can be mathematically reproduced.)

This report deals extensively with the development of the gravity model. It analyzes earlier developments in gravity model techniques as used in transportation studies and reviews recent efforts throughout the country. A portion of the report deals with the mathematical development of the model as well as the derivation of input data.

As a first step, the Inner Belt report assigned 1975 traffic to the expressway system on a free assignment basis without regard to expressway capacity. It was found that on this basis many segments of the expressway system would be overloaded beyond their capacity by 1975. Some sections of the system showed assigned traffic volumes three to four times their capacity. Traffic volumes of about 500,000 vehicles per day were predicted by 1975 for a section of the Inner Belt with a capacity of about 160,000 vehicles per day. The most heavily loaded radial route would be the Southeast Expressway, where the volume south of the Inner Belt is estimated to exceed 300,000 vehicles per day. Route 128 is the only highway which was projected to show an excess of capacity in 1975 because of its recent widening and also because construction of the Inner Belt was assumed as completed.

After an initial free assignment, new assignments of traffic were made to adjust volumes to traffic capacity of the expressways. It was implied that excess traffic demand would be handled by arterial streets. The capacity-adjusted traffic assignment was designed to provide information for the design of interchanges.

c. *Major Proposals and Recommendations*

The purpose of this report was the preparation of location studies and recommendation of basic design for the sections of the expressway system which remain unbuilt. The primary recommendation was that the expressway system for the Boston area should be completed as soon as possible to take full advantage of the road-user benefits for motorists using the expressways. In addition, the report predicted significant socio-economic gains as a result of completion of the expressway system and that coordination with several urban renewal projects would yield benefits both to the communities involved in renewal and to the DPW in constructing these expressways. The report indicated that while families and businesses would be displaced due to expressway construction they would be aided by an organized approach to the relocation problem by urban renewal agencies.

A four-stage program of construction is proposed with the entire program to be under construction by 1969. Stage One projects include completion of I-93 to the Inner Belt, construction of the Inner Belt between I-93 and the Central Artery, and completion of a section in Boston between Brookline Avenue and the Charles River. The full Inner Belt would not be completed until the final stage.

d. *Summary*

This report's strength lies in its careful analysis of the location of the unbuilt portions of the system. Each route and the alternates were investigated with an unprecedented amount of detail, including socio-economic effects as well as the more conventional physical aspects of highway construction. Unfortunately, while it recognized the need for coordinated mass transportation and expressway system, a study of mass transportation needs and methods of coordination with highways was beyond its scope.

F. *Summary*

The lack of up-to-date travel information in the Boston region has been a serious handicap to planning. The 1948 Master Highway Plan was based on information collected specifically for that purpose. However, of the three major highway plans prepared since that time, only one involved the collection of additional data to update the 1948 information, and two reports have relied on the gravity model technique to develop traffic assignments for an expressway system. While each of these studies has some value, the basic regional expressway plan is still based on the traffic data collected nearly twenty years ago in a very different environment.

A major deficiency is the lack of coordination in planning highway and rapid transit improvements although 4 of the 5 major reports reviewed here mentions the need to maintain public transportation and to coordinate it with other modes of transportation. However, only one report, the B.C. Seminar study, attempted to coordinate improvements to highways and mass transit facilities. No study in the region indicated clearly the manner in which highway and transit facilities can be coordinated, the effect of the construction of either type of facility upon the other, nor the comparative advantages and disadvantages of alternative transportation mixes to the users and residents of the region.

The review of highway planning studies shows many innovations and advances in the techniques and art of traffic assignments and highway design. The quality of the reports reviewed compare favorably with those produced for other cities in the nation and the Boston region can take pride in its highway planning activities. In the future, however, studies of transportation in the Boston region must accumulate new data, realistically coordinate highway and transit improvements, and analyze the effect of these improvements and their alternatives.

3. THE ROAD-BUILDING AGENCIES AND MAJOR TRAFFIC FACILITIES

A. *General*

Within the Boston region five public agencies build or operate automobile traffic facilities: (1) the State Department of Public Works, (2) the Massachusetts Turnpike Authority, (3) the Metropolitan District Commission, (4) the Massachusetts Port Authority, and (5) individual communities.

The State Department of Public Works is the most important of these agencies. It is responsible for all construction financed by the state and is the official state agency through which federal highway funds are

channeled. The DPW, responsible for the entire state highway system, focuses much of its attention on the Boston region where a majority of the state's highway construction funds are spent.

The Massachusetts Turnpike Authority is responsible for three facilities in the region: (1) the Massachusetts Turnpike, 26 miles of which is within the region; (2) the 12-mile Boston extension of the Turnpike; and (3) the Sumner and Callahan Tunnels. The Turnpike Authority ranks second in amount of money expended on highways in the region.

The Metropolitan District Commission Parks Department over a period of years has been assigned some of the most critical traffic facilities within the region. Storrow Drive and Morrissey Boulevard, for example, are under the jurisdiction of the MDC.

The Massachusetts Port Authority has jurisdiction over only one major traffic facility, the Mystic River Bridge.

Finally, there are the individual communities which have primary responsibility for local improvements on the roadways that comprise 90% of the mileage of the region's highway and street system. Most of this mileage is in local residential streets and is not part of the regional arterial system. The larger part of local road-building funds are used to match state funds under the Chapter 90 Highway Program. In many communities Chapter 90 matching funds are frequently the only set expenditures for highway improvements, although additional funds are incorporated in annual appropriations to local public works departments.

B. *The Department of Public Works*

The State Department of Public Works, is responsible for most of the highways within the Boston region. The entire expressway system, except for the Massachusetts Turnpike, falls under its jurisdiction. Organized as a commission in 1892, the Department of Public Works was established in its present form by general acts of the 1919 State Legislature. The department maintains its headquarters in downtown Boston. In addition to the headquarters offices, the state is divided into eight engineering districts supervised by District Engineers, with headquarters at district offices. Department activities in the district parallel those in the headquarters although the emphasis at district offices is on maintenance work and Chapter 90 assistance; work required on major projects is usually carried out through the Boston headquarters.

As of July 1, 1961, the DPW was responsible for almost 2,500 miles of state highway, of which 900 miles were within the Boston region. (There were approximately 24,000 miles of local roads within the State, of which 10,000 were located within the region.) There are approximately 372 miles of expressways in the region and an additional 523 miles of primary and secondary roads under DPW control. These primary and secondary roads range from major highways like Route 20 and Route 9 to relatively minor roads traversing the fringes of the region such as Route 40 and Route 109.

The allocation of state highway mileage among the state's communities is determined by the DPW; however, there is no rigid formula for this allocation. The heavily populated core communities clustered around Boston have relatively limited amounts of route mileage in the state highway system in contrast to suburban areas. This results from the fact that the highways connecting major cities pass through mostly open country. One community may have virtually no state mileage while an adjacent town, traversed by intercity routes, may have as much as 15 or 20 miles within its borders. A community which is served by state highways receives several benefits, since the DPW improves and maintains state roads and provides snow plowing, salting and sanding operations during the winter months.

While the Department of Public Works maintains a logical system of primary, secondary and urban highways which form the state highway system, identification of this system is somewhat difficult, because: (1) contiguous sections of roadway may be under state or local jurisdictions; (2) designation as federal primary numbered routes (those identified by a number in a shield) does not necessarily imply a state highway in the aid program; (3) some state numbered routes are not included within the federal-aid systems and are locally supported. The numbering system on the region's highways for both the federal primary and state numbered routes, is for guidance purposes only and does not indicate either the type or amount of financial aid received from the state or the federal government. Figure 30 shows the federal aid highway system in the Boston area.

C. *The Massachusetts Turnpike Authority*

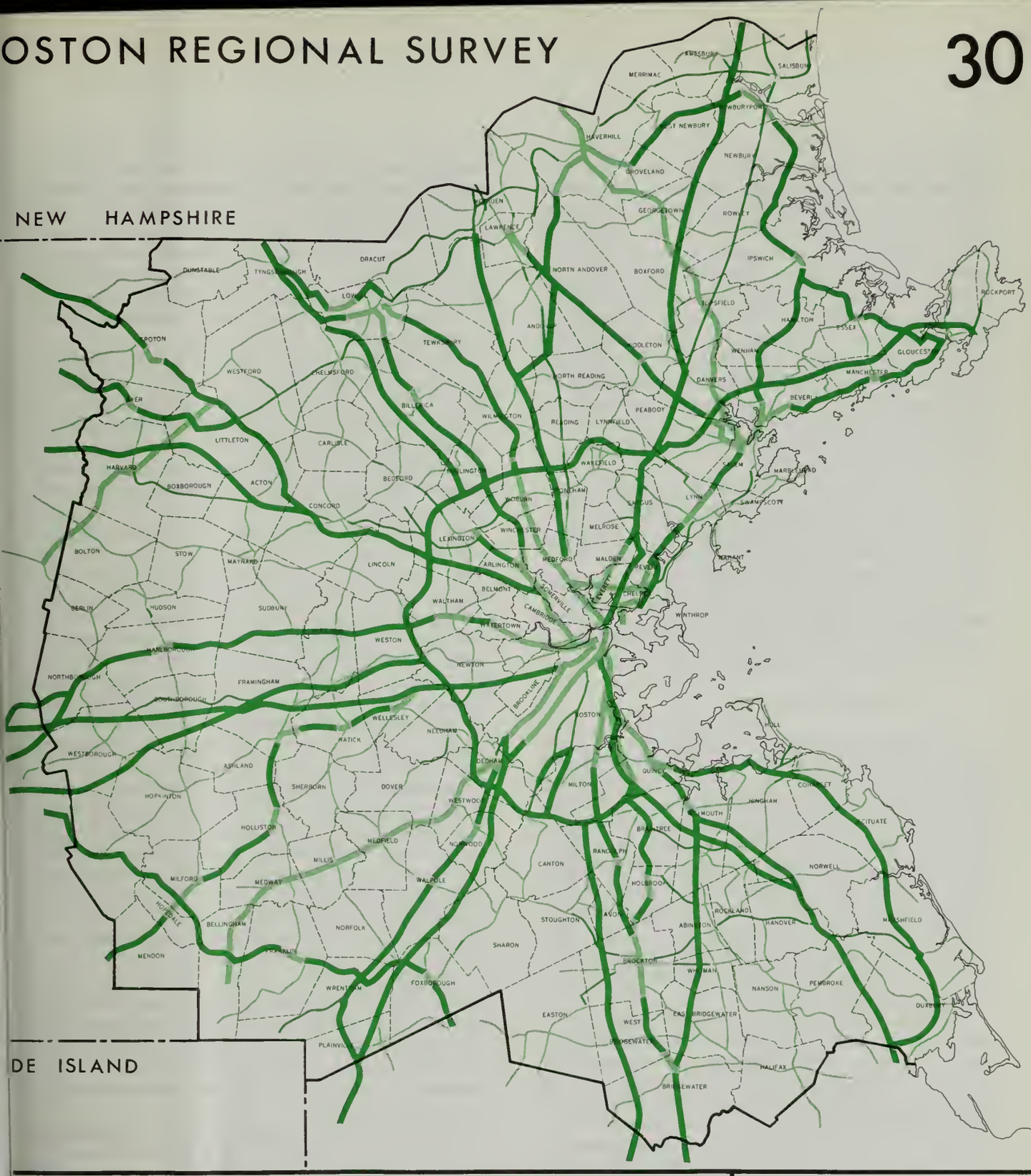
Created by the State Legislature in 1952, the Turnpike Authority was empowered to construct a toll highway facility from a point in the Boston area to the New York state line.[2] The initial Turnpike, 123 miles in length between the New York state line and Route 128 in Weston, was financed through a $239 million bond issue in 1954. Construction was rapid; three years after the bonds were sold the entire road was open to traffic. Since the turnpike terminated at Route 128, core-bound vehicles were forced to transfer to the local highway system utilizing such routes as 2, 9, 16, 20 and 30.

The enabling legislation of 1952 was modified in 1955 to permit turnpike construction to a point within the city of Boston. (The original act provided for termination at a point "in the vicinity of Boston.") However, construction of the extension was delayed because sale of the $180 million bond issue required for the 12-mile extension did not take place until early 1962. A primary

2. Acts and Resolves 1952, Chapter 354.

OSTON REGIONAL SURVEY

30



FEDERAL AID HIGHWAY SYSTEM IN THE BOSTON REGION

- STATE HIGHWAY – PRIMARY SYSTEM
- STATE HIGHWAY – SECONDARY SYSTEM
- LOCAL ROAD – PRIMARY SYSTEM
- LOCAL ROAD – SECONDARY SYSTEM

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

D FOR THE MASS TRANSPORTATION COMMISSION

THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

reason for the seven-year delay was the enactment of the Federal Highway Act of 1956 authorizing 90% federal assistance to the Interstate System. Many expected that the availability of 90% federal funds would doom toll roads. Eventually, when it became apparent that turnpikes could still be built and financed successfully, problems in location arose, particularly in Newton where the Turnpike Extension involved extensive damages to existing land uses and properties. Later, when these problems were resolved and a prospectus for the bonds was issued, further difficulties were encountered, partly as a consequence of the depressed bond market in the 1961 business recession. Finally, a successful formula was found to interest investors and the bonds were sold early in 1962.

In addition to the Turnpike and Turnpike Extension, in 1959 the Authority issued $52.8 million in Tunnel Revenue Bonds to finance construction of a two-lane tunnel to parallel the existing Sumner Tunnel. Ownership of the Sumner Tunnel was transferred to the Turnpike Authority so that both tunnels could be operated as a single toll project. By the middle of 1962 both tunnels were in full operation alleviating a traffic bottleneck which had existed for many years.

D. *The Turnpike Extension*

The Turnpike Extension is being built as a toll facility on the Interstate System and will provide an extremely useful regional highway link since no western radial expressway now penetrates inside Route 128. The Extension will be located within a traffic corridor consisting of Routes 9, 16, 20 and 30, all of which are congested during peak hour periods, particularly those sections close to downtown Boston. Routes 9 and 16 pass through heavily developed areas and clusters of commercial and industrial development. Route 20 traverses the business district of Waltham and Watertown and provides primarily local service although it is used heavily by through trucks.

The Bond Prospectus (January, 1962) shows that the time now required to reach Route 128 in Weston, the present entrance to the turnpike, from downtown Boston is about 40 minutes. It is estimated that the same trip on the Extension will take between 20 and 25 minutes, depending on the time of day.

The Extension will be used by motorists already on the turnpike who wish to reach destinations in the core. It will be easy to reach the Extension from the other routes in the western traffic corridor, since Route 128 will act as a "yoke" between Routes 9 and 20, collecting inbound traffic from radial highways outside Route 128 and focusing it on the Turnpike Extension.

It is probable that even after completion of the Extension, traffic volumes on the western arterials will continue to be high since these roads traverse extensively developed residential, commercial and industrial areas which generate large amounts of traffic. In 1959 the combined volumes of Routes 9, 16, and Route 30 just inside Route 128 was 94,000 vehicles per day. Crossing Massachusetts Avenue, the volume in this traffic corridor, including Storrow Drive, was nearly twice as great.[3] In addition, the infrequent interchange spacing on the Extension will not permit it to absorb short local trips. Thus, the Extension may not appreciably reduce present volumes on parallel routes although it will relieve future pressure on them.

The Turnpike Authority estimates that traffic volume along the eight-lane section will be 102,000 vehicles per day by 1970. Based on experience in other parts of the country this volume would be within the capacity of the facility.[4] The Bond Prospectus indicates that capacity may be reached sometime after 1970, and toll rates may then be increased in an attempt to control volumes and prevent congestion.

The seven interchanges along the Turnpike Extension will have significant traffic impact on local road systems. Spaced about two miles apart on the average, some interchanges will be constructed at locations where traffic is already concentrated and congestion is a serious problem. For example, Newton Corner, formed by the convergence of several major streets will also become a focal point of turnpike-oriented traffic. While major improvements will be made by the Turnpike Authority, the estimated 28,000 vehicles that will use this interchange in 1965 will add to the traffic load of approach streets and may cause local congestion.

The interchange in Allston, 2.4 miles from the Prudential interchange, is another example. This is the closest interchange to the downtown area that serves traffic in all directions and it is in this section that motorists may find the greatest savings in time. A total of 33,000 vehicles daily are expected to use this interchange for trips to and from the east. An additional 18,000 are expected to use the interchange to and from the west.

Since the Extension is expected to take three years to construct, there is adequate time to plan for the impact of these interchanges on the local street system. The Boston Redevelopment Authority has already initiated studies to determine the effect that the Extension interchanges would have on Boston's streets and traffic circulation pattern.

While initial plans for the Extensions do not provide for an interchange with the Inner Belt it is expected that such a connection will be built in Allston when the Belt route is constructed.

E. *Metropolitan District Commission*

The Metropolitan District Commission, a state agency which concentrates most of its operations within a 15 mile radius of Boston, is responsible for some of the

3. Massachusetts Turnpike Authority, *Bond Prospectus* (January 1, 1962), p. 43.
4. Highway Research Board, Committee on Highway Capacity, *Observed Peak-Hour Volumes on High Traffic Flow Facilities*, 1961.

most important highway facilities in the Boston region. Although several highway facilities fall under the jurisdiction of the MDC, it is not primarily a road-building agency. It does, however, play a significant role in the region's highway construction. The majority of MDC road construction work is devoted to upgrading roads by pavement widenings, overpasses and traffic control. Examples of this are the improvements to the Fellsway including Wellington Circle, the recently completed improvements to Soldiers Field Road as an extension of Storrow Drive and the improvements to Morrissey Boulevard.

In addition to facilities which are part of the regional road system and fall under MDC control merely for maintenance and improvement purposes, some roads within MDC reservations are part of the regional road system. For example, roads in the Middlesex Fells and Blue Hills Reservations are used by through traffic not destined for these recreation areas.

a. *Existing MDC Facilities*

Storrow Drive running along the south bank of the Charles River is the most heavily traveled facility operated by the MDC. This road carries over 100,000 cars per day near the Esplanade, rivaling the Central Artery as the region's busiest highway. Storrow Drive, as well as most other MDC facilities, is limited to passenger cars only.

The Jamaicaway is another major MDC route. It extends from the Boston University Bridge along a strip of park reservation as far as Forest Hills in the southern part of Boston. From here it connects with Morton Street and the Veterans of Foreign Wars Parkway, both of which are MDC roadways. The latter continues south as Route 1 as far as the Boston-Dedham Line.

Other MDC roads carrying significant traffic movements are the Lynnway, Revere Beach Parkway and Alewife Brook Parkway. The latter two roads connect several important northern radials including Routes 2, 3, 38, 28, I-93, 1, 107 and 1A. They are part of a continuous parkway development from the west Cambridge-Arlington area to the north shore beaches. In its present location this segment of parkway serves as an intermediate belt distributing traffic between the radials outside the congested core. Design standards vary along the route, but there are at least four lanes along most of it and up-to-date traffic control devices at most intersections.

In 1962 a $20 million bond issue was authorized by the legislature to provide funds for several improvements on the MDC road system. Major emphasis will be placed on improving Memorial Drive in Cambridge. Grade separations will be constructed at the intersections of Western Avenue, River Street and Boylston Street, which have been the source of frequent peak hour congestion. The Drive will be further improved by extending it from the Eliot Bridge rotary in Cambridge to Arsenal Street in Watertown. This improvement will eliminate a dead end and will provide a continuous route along the north bank of the Charles River as far west as Watertown Square where it will connect with Route 20.

Other improvements include construction of overpasses in the Charlesgate area to accommodate Storrow Drive traffic. This should have a significant impact on traffic circulation in the Back Bay, since this interchange has been a continual source of congestion particularly during peak hours when traffic backs up along Storrow Drive and other roads leading into this complex district.

Other improvements proposed in this program will be the widening of MDC Parkways beyond Concord Avenue in west Cambridge and along the Arlington-Somerville Line. No grade separations are proposed for this widened section.

Morton Street and Gallivan Boulevard will also be improved under the new construction program. These streets designated as Route 3, 28 and 138 form a continuous roadway between the Forest Hills and Neponset Circle areas of Boston. The MDC will eventually provide a full four-lane facility between the above areas to serve as a high quality circumferential connecting these three important radials.

b. *The Parkway System*

The original system of roads in the MDC parkway system was intended to provide internal access to large public open spaces, to interconnect park and recreation areas and to link centers of population with the park system. As early as 1925, however, it was recognized that the parkway system could provide and in fact would be forced to provide automobile traffic capacity to supplement inadequate city streets.[5] The parkways with their wide borders of grass, waterways, plantings and trees were easily susceptible to widening, at first for intersection improvements and then for limited widenings and straightening of roadways.

The 1925 report suggested that there would be a powerful incentive to defer local street improvements, which would require taking homes and businesses, in favor of widening parkways where right-of-way could be acquired at little or no cost. The report also pointed out that connections with major arterials would adversely affect the parkways by making them, in effect, segments of the arterial street system.

The prophecies of 1925 have been abundantly realized. Two recent examples are Soldiers Field Road where widening and intersection improvements involved cutting down large numbers of trees bordering the roadway, and the Arborway, near Forest Hills, where construction of a median strip required elimination of a service road and a separator strip lined with trees.

5. Boston Park Department, *Future Playgrounds and Parkways* (November, 1925), pp. 44-50.

In addition to these encroachments by traffic on the region's parkways, expressways have also taken large amounts of open recreational space. In the Blue Hills Reservation, Route 128 has cut a wide swath not only for the main line of the expressway, but also for a directional interchange with Route 24. To the north, Interstate 93 has virtually bisected the Middlesex Fells. At least two other expressways, I-95 South and Route 3 are expected to occupy land now classified as public open space.

F. *The Massachusetts Port Authority*

The Massachusetts Port Authority has jurisdiction over the Mystic River Bridge and the road system serving Boston-Logan Airport. The bridge was built by a special Mystic River Bridge Authority which was dissolved when control of the Bridge was transferred to the Port Authority. Other than the operation of the bridge, the Port Authority at present does not build nor maintain any other facilities of regional traffic significance.

G. *Parking Facilities*

The parking situation in the Boston region cannot be analyzed in a regional perspective, but the provision of parking spaces has vital implications for the core and other parts of the region. The land surrounding major intersection points on the expressway system frequently becomes intensively developed, requiring a large supply of parking spaces. The development of large parking areas usually requires substantial traffic generation and good vehicular access.

The first approaches to parking were generally unplanned and sporadic. Parking lots were usually small, located on unused, remote parcels of land and parking was usually confined to ground level use only. During the last five years, however, there has been a more positive attitude toward provision of parking facilities. This has resulted from problems which have emerged as new expressways have been put into service and because the automobile has been accepted as a major mode of transportation to the downtown Boston area, particularly during off-peak hours.

The city of Boston has engaged in a program to provide additional parking spaces for various parts of the business district. There are now approximately 32,000 parking spaces in the downtown Boston area.[6] (As a comparison there are a total of 20,000 parking spaces in the region's three largest suburban shopping centers.) Of these, about 26,500 are in off-street locations and 5,500 are at the curb. The majority of curb spaces are metered. In addition to these legal spaces, there are an estimated 3,500 additional regularly used, illegal spaces.

The *General Plan for the Central Business District,*[7] estimates that an additional 10,000 off-street spaces are needed in downtown Boston. Major portions of this goal have already been translated into positive action. The underground Common Garage, completed in late 1961, provided 1,500 spaces. The new Government

6. Robert H. Murphy, "The Disappearance of Railroad Commutation in Boston" (unpublished Master's Thesis, Massachusetts Institute of Technology, 1959), p. 110.
7. Boston Redevelopment Authority, *A General Plan for the Central Business District* (Boston, 1960).

TABLE 39

MAJOR PARKING FACILITIES IN THE BOSTON REGION

Facility	Location	Function Served	Access Routes	No. of Spaces
Northshore Center	Peabody	Shopping	Rts. 114, 128	8,000
Shoppers World	Framingham	Shopping	Rts. 9, 30, I-90	6,000
Southshore Plaza	Braintree	Shopping	Rt. 128 Southeast Exp.	6,500
Riverside Station	Newton	MTA	Rt. 128	1,600
Boston Common Garage	Downtown Boston	Shopping and Offices	Arterial Streets	1,500
Prudential Center	Back Bay Boston	Offices, Hotel, Auditorium	Turnpike Extension	4,000[1]
Government Center	Downtown Boston	Offices	Central Artery	2,500[1]
Off-Street Spaces	Downtown Boston	Shopping, Offices	Arterial Streets	26,000

1. Under Construction

Source: Robert H. Murphy, "The Disappearance of Railroad Commutation in Boston." (Unpublished Master's Thesis, Massachusetts Institute of Technology, 1959), and other sources.

Center Project, under construction in late 1962, will initially provide 1,600 to 2,000 spaces in a main garage structure. Other parking facilities in the project will provide an additional 500 to 1,000 spaces. The Prudential Center will provide 2,500 spaces initially with additional spaces to be provided by a hotel now under construction. In October, 1962, plans were presented to provide an additional 1,000-car parking facility for the Prudential Center at the city auditorium.

In addition to parking terminals that are definitely planned, several proposals for other parking facilities have been made. The South Station area has been suggested as a possible location for a 7,000 car parking facility, although this large number of spaces may be difficult to provide in one location because of operational difficulties. A major parking terminal in this same location was proposed in 1955 in a report prepared for the Boston Terminal Corporation. The report recommended a facility that would provide 1,174 spaces, and it pointed out (but did not recommend) that direct ramps from the Central Artery to the garage could be built.[8]

The Boston Redevelopment Authority is currently studying the possibility of providing major parking facilities at certain interchanges of the Turnpike Extension. Parking at these locations, close to interchanges would have the effect of reducing the amount of traffic on the downtown arterial street system. This would be accomplished by intercepting automobiles coming off the Turnpike before they reach the local street system. Boston has $5 million remaining from bond issues which could be spent on parking garages to advance this program.

In addition to core parking facilities, the region contains a number of very large parking terminals in the suburbs. For example, the three major regional shopping centers in Peabody, Framingham and Braintree each have between 6,000 and 8,000 parking spaces. The Metropolitan Transit Authority also utilizes large fringe area parking lots to accommodate commuters, maintaining a total of approximately 5,800 parking spaces. Some of the larger lots include Everett (400), Lechmere (385), Wonderland (480), and Riverside, the largest, (1,600). The MTA plans to construct additions to its parking facilities; in particular, proposals for rapid transit extensions involve construction of large parking areas at intermediate and outer terminal stations.

The actions and proposals outlined above point out the extent to which parking facilities are now being planned, in contrast to earlier haphazard approaches. They also point out the change in the magnitude of parking facilities which has taken place in Boston. Small lots are no longer considered viable. Virtually all single facilities mentioned will provide space for a minimum of a thousand cars. Unlike the highway system, however, the general responsibility for the planning and construction of off-street parking has not been clearly defined. The underground Common Garage was built by a special authority, the initial parking supply of the Prudential Center will be supplied by the developer, the city auditorium parking garage will be constructed by the city. The only major unified parking program undertaken by a city in the region has occurred in Boston. During the late 1950's, the city engaged in a parking garage program to ring the downtown business district. Although $10 million bond issues were authorized for this purpose, one in 1946 and another in 1955, only about $15. million has been spent so far in this program.

Despite the lack of centralized control over parking, current plans by a variety of agencies indicate that there is coordination between these agencies. Furthermore, recognition has been given the need for parking to accompany highway improvements and the construction of traffic generators. As recently as 1955, when the Central Artery was constructed, little attention had been given to the possibility of providing parking facilities beneath or in conjunction with the elevated structure. However, since that time several locations beneath, above and adjacent to the highway have been developed for parking.

H. *Trucking Facilities*

Trucking activity has increased in the region at the expense of local railroads. This trend is in line with national patterns. Employment figures tell the story: During the 1950-1960 decade railroad employment in the nation declined by 400,000 while the trucking industry increased by 200,000 jobs. Trucks in the region generally composed about 10 to 20% of the traffic streams, a pattern which is comparable to other metropolitan areas. Some parts of the region, however, experience much larger percentages of truck movement. For example, a recent study in highly industrialized Cambridge found that the percentage of trucks in the traffic stream ranged between 20 and 40%.[9]

Although Somerville, Charlestown and other core areas have developed extensive trucking areas, there are no planned or coordinated major concentrations of truck terminals in the region. The greatest concern in terminal development has been shown by the city of Boston. In 1946 a plan was prepared to guide the growth of truck terminals within the city recommending construction of one or two terminals close to the downtown area, one north and one south of the CBD.[10] It was estimated that nine acres would be needed for both terminals whose combined capacity would be approximately 200 spaces. The city is now in the process of preparing renewal plans for its downtown area which will include specific recommendations for trucking facilities.

8. Clarkeson Engineering Company, *Feasibility Study, The Boston Terminal Corporation Parking Garage* (Boston, 1955).

9. Cambridge City Planning Board, 1961, unpublished data.
10. Boston City Planning Board, *Report on a Union Motor Truck Terminal for Boston*, October, 1947.

Some trucking firms have located major terminals in the suburbs along Route 128 and along the radial highways where company shipments are consolidated for final delivery.

4. TOTAL REGIONAL HIGHWAY EXPENDITURES

The largest share of regional highway expenditures is derived from the Massachusetts Department of Public Works which expends both state and federal funds for construction, improvement and maintenance of the regional highway system. Of the other major road building agencies, the Massachusetts Turnpike Authority and the Metropolitan District Commission also spend considerable sums for highways. In addition, each community is responsible for building, improving and maintaining most of the roadways within their jurisdictions.

A. *The Department of Public Works*

The Department of Public Works spends a major portion of its funds in the region which includes 60% of the state Interstate Highway mileage and most of the costly urban construction. Many of the region's roads traverse densely built-up areas and tend to be substantially more costly than roads elsewhere in the state.

In 1960 the state Department of Public Works received $86 million in federal funds for federal-aid highway construction. The state's share in this program was $24 million for a total appropriation of $110 million. Table 40 shows federal and state expenditures in Massachusetts.

TABLE 40

FEDERAL AID RECEIVED BY MASSACHUSETTS AND REQUIRED MATCHING FUNDS: 1946 to 1960

Year	Federal Aid (000's)	State Matching Funds (000's)	Total
1946	$10,342	$10,342	$ 20,684
1947	10,342	10,342	20,684
1948	10,208	10,208	20,416
1950[1]	9,188	9,188	18,376
1951	9,196	9,196	18,392
1952	8,933	8,933	17,866
1953	8,849	8,849	17,698
1954	10,156	10,156	20,312
1955	10,225	10,225	20,450
1956	16,356	15,138	31,494
1957	40,014	19,817	59,831
1958	52,063	19,801	71,864
1959	62,891	22,109	85,000
1960	85,876	24,124	110,000

1. No information available for 1949.

Source: U.S. Department of Public Works, *Highway Statistics, 1955 Summary* (Washington, U.S. Government Printing Office), and Massachusetts Department of Public Works.

Future estimated expenditures for expressways in the Boston region are shown in Table 41. It is anticipated that a total of $393 million will be spent by the DPW in the Boston region before 1975 in interstate highways alone. In addition, another $99.5 million is expected to be spent on other federally aided expressways and $147 million will be spent for the Turnpike Extension. None of these figures include improvements and new sections of roadways that are not part of the expressway system or maintenance costs on existing portions of the highway system.

In addition to participation in the federal aid systems, the state contributes to local road financing through the Chapter 90 and Chapter 81 programs. The Chapter 90 program provides a limited amount of state highway funds to be spent, together with matching funds from the municipality and county, for maintaining, repairing, improving and constructing municipal and county highways. The Chapter 81 program provides for the expenditure of funds for the repair and improvement of public ways other than state highways in towns having valuation of under $5 million and a road mileage ratio based on state tax and local mileage. The state contributes $275 per mile and the municipalities $15 to $150 per mile, depending on the road mileage ratio.

Chapter 90 construction financing is usually determined by a ratio in which the local community contributes 25% of the cost of the project, the county provides 25% and the state highway department provides 50%. The allocation of Chapter 90 funds among the state's municipalities from the Department of Public Works is based on a formula which includes population, town area and road mileage. Within the Boston region, Chapter 90 assignments for 1961 totalled $6.4 million, including state, county, and local contributions. This figure represents a little under 50% of total statewide Chapter 90 expenditures.

In addition to these funds, the smaller communities which qualify for Chapter 81 funds received additional aid. Within the Boston region 48 communities were eligible for Chapter 81 funds in 1962. Total Chapter 81 funds assigned to these communities in 1962 was $965,000. This includes the local contribution to the Chapter 81 program which averages about 25% of the total amount. Chapter 81 funds may be used for snow removal and sanding operations up to a predetermined maximum.

A one-time input of local highway construction funds occurred in 1956 when Chapter 718 of the Acts and Resolves of the State Legislature, which provided funds for State highway construction, contained a provision which allotted a specific amount of money to each community in the state to be spent for the improvement or construction of roads. A total of $15 million was provided for this purpose. While the overall effect was beneficial, some communities used these funds as their contribution to the Chapter 90 program.

TABLE 41

ESTIMATED COST TO COMPLETE BOSTON REGION EXPRESSWAY SYSTEM

Highway	No. of Miles	Estimated Cost (000's)
Interstate System		
Inner Belt (695)[1]	7.1 or 6.2	$129,600
Outer Belt (495), Various Segments	79.3	120,600
Northeast Expressway (95)		
Danvers - Revere	11.8	30,200
Northern Expressway (93)		
Medford - Inner Belt	1.8	10,900
Massachusetts Turnpike (90)		
Rt. 128 - Central Artery	11.5	180,000
Southwest Expressway (95)		
Foxborough - Inner Belt	26.8	101,700
Total Interstate		573,000
Other Federal-Aid Expressways		
Route 128 Widening (Rt. 93-Rt. 9)	16	29,000
Route 3 (128 - Cambridge)	7	22,000
Route 2 (Acton - Inner Belt)	19	41,000
Route 3 (Duxbury)	6	4,000
Route 3 (Tyngsborough)	3	3,500
Total Other Expressways		99,500

1. The recent Inner Belt report included costs for core area sections of the expressway which in general are considerably higher than those in the table. For example, the total cost of the Inner Belt was estimated at $168.8 million as compared to $129.6 million in the table.

Source: A Report of Progress to Governor John A. Volpe, Massachusetts Department of Public Works, Fall, 1961.

In summary, over $7 million is spent annually on the DPW-controlled Chapter 90 and Chapter 81 programs. About half is contributed from DPW funds and the remainder by counties and local communities.

B. *Massachusetts Turnpike Authority*

Although the Turnpike Authority controls a relatively small amount of roads in the region (about 26 miles of the Turnpike and the 12-mile Extension under construction), the high cost of its facilities make it the second largest contribution of highway funds in the region.

Since 1954 when the initial Turnpike was put under construction the Authority has spent about $48 million for the 26 miles of Turnpike within the region,[11] $32 million for the construction of the Callahan Tunnel and modernization of the Sumner Tunnel and has begun $147 million worth of construction to build the Turnpike Extension into Boston.[12] With the Turnpike Extension expected to be completed by 1965, the Authority will have spent approximately $227 million for highway construction in the region in an eleven year period.

C. *Metropolitan District Commission*

The Metropolitan District Commission is also an important highway construction agency in the Boston region. Generally speaking the expenditures of the MDC may be divided into three categories: new construction, reconstruction, resurfacing and maintenance.

In new construction, an average annual figure is difficult to determine since funds for new construction are not allocated on an annual basis. In 1956, $16 million

11. Based upon the average cost per mile of the entire turnpike.

12. These figures for Turnpike Authority construction are less than total bonds issued. Total bond issues include interest costs during construction, initial operating costs, professional fees and other expenses normally incurred.

out of a $200 million bond issue approved by the state legislature for highway improvements was allocated to the MDC. At that time an additional $15 million from prior issues remained unspent. It is estimated that between 1957 and 1961 a total of $27 million was spent on new construction by the MDC.

In 1962 a $20 million Highway Construction Program was announced by the Metropolitan District Commission. As in similar previous construction programs emphasis was placed on increasing the capacity of existing MDC facilities. As was noted above, under the proposed program several grade intersections along Memorial Drive, River Street, Western Avenue and Boylston Street are to be converted to grade separated structures similar to the program which converted Soldiers Field Road to a limited access facility.

It has been estimated that annual expenditures by the MDC for resurfacing amount to about $300,000 per year. However, it is expected that in the future this figure may increase in view of the many new roads that have been assigned to the MDC. It is estimated that the Metropolitan District Commission spends approximately $10 million per year to maintain their network of roads. Of this amount approximately $4 million per year is spent on snow removal and other operational costs.

D. *Massachusetts Port Authority*

Insofar as regional highways are concerned, the Port Authority is not engaged in construction of new facilities. Its only expenditures on regional highways are for maintenance and operation of the Mystic River Bridge for which it expends about $700,000 annually.

E. *Local Road Expenditures*

Expenditures for local roads and streets are derived from a variety of sources and are difficult to estimate. Most local road funds are spent on maintenance and snow plowing. These funds, as well as other amounts allocated for repair or construction of small segments of roadway, are often not identified in the budgets of local public works or highway departments. Maintenance is usually limited to filling pot holes, weed control, snow plowing and resurfacing. Frequently, the local highway department will perform the required road construction work in connection with Chapter 90 and Chapter 81 projects.

Local authorities spend less on roadway improvements than the other road building agencies, but are responsible for most of the mileage in the region. However, local roads accommodate only about one-third of the region's total vehicle mileage.

F. *Summary*

Highways accommodate most of the trips made in the Boston region. Responsibility for construction and maintenance of the highway net is divided among several agencies. The Department of Public Works is the most important with regard to the amount of money that is spent on highways and in the number of vehicle-miles of travel accommodated. Because various agencies are responsible for various elements of the highway system, the costs of additions and improvements, maintenance and operation are difficult to define and measure. However, it is estimated that approximately $90 million will be spent annually for new construction and major reconstruction projects in the region during the next several years.

The lack of an overall authority to guide the development of the road system had led to congestion in several areas caused by a lack of coordination between various agencies. Concentration on traffic arterials coupled with neglect of feeder streets has resulted in severe congestion, particularly in the core communities. This situation will become progressively worse if the state continues to spend large sums of state and federal funds for expressway construction and leaves the feeder system to be financed primarily by inadequate local funds.

5. TRAFFIC CHARACTERISTICS

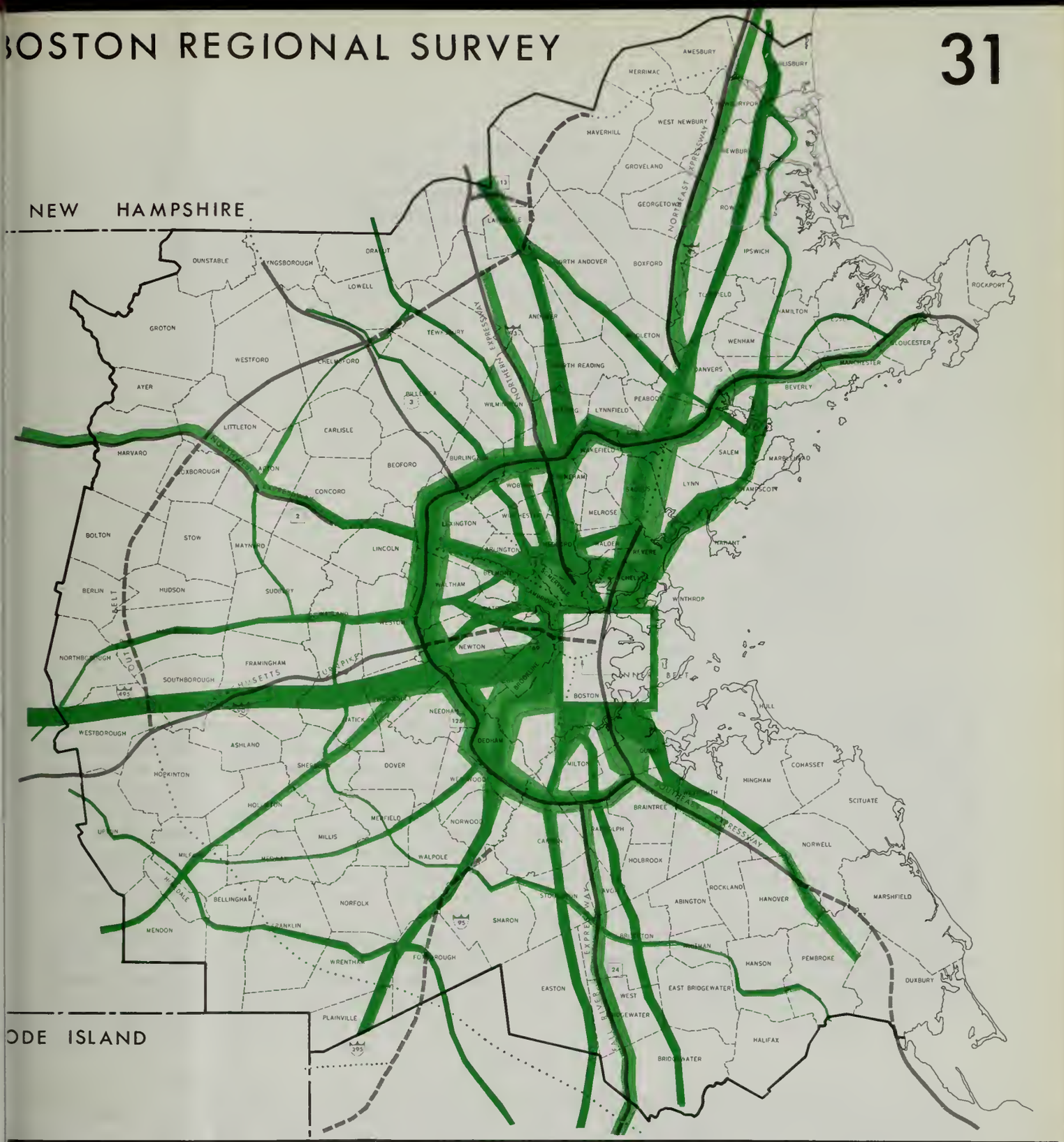
A. *Traffic Volumes*

The Department of Public Works maintains an extensive traffic counting program on the state highway system. Many locations in the region are counted 24 hours per day the year round. Other points are counted one week each month and some points less frequently. This program results in an up-to-date picture of traffic volumes. Much of the traffic volume data in this report has been taken from DPW counts.

The pattern of traffic volumes encountered in the region is similar to that in other major urban areas. The heaviest volumes are found in the region's hub. The Central Artery which carries the heaviest volume of traffic, at one point carries 110,000 vehicles per day on a six-lane section near High Street. Storrow Drive currently carries 80,000 vehicles per day along the six-lane section east of Massachusetts Avenue, and about 100,000 per day near the Esplanade. Table 42 presents 1960 traffic volumes at selected locations throughout the region, particularly some of the more heavily used facilities.

Less than ten years ago traffic volumes of this magnitude were unknown in the Boston area but in recent years construction of high-capacity, limited-access roads has permitted an unprecedented volume of traffic to funnel onto major routes. In 1951 maximum volumes in the region were in the 40,000 to 50,000 vehicles-per-day range. Within a period of 10 years, maximum volumes in the region doubled. This is illustrated in Figure 31 which shows traffic flow, for 1951 and 1960.

Some traffic facilities show spectacular growth for the decade. On Route 128, for example, volume on the four-lane section in Waltham and Lexington more than



TRAFFIC VOLUME FLOW MAP, 1951 AND 1960

1951
1960

ADT (000)

SOURCE: MASS. D.P.W. ANNUAL FLOW MAPS

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

PREPARED FOR THE MASS TRANSPORTATION COMMISSION
THE PLANNING SERVICES GROUP, CONSULTANTS

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TABLE 42

AVERAGE 24-HOUR VOLUMES ON SELECTED MAJOR ROUTES IN THE BOSTON REGION, 1960

Route	Location	1960 Average Daily Traffic
Central Artery	High Street Exit to Sumner Tunnel	110,000
Storrow Drive	East of Massachusetts Avenue	80,000
Mystic River Bridge	Mystic River	58,340
Southeast Expressway	Neponset River	51,200
Route 1	Saugus, South of Route 129	46,190
Route 128	Lexington, South of Route 2	42,370
Blue Hill Avenue	Boston-Mattapan Square	39,930
Route 128	Reading, East of Route 28	29,490
Route 1	Westwood, South of Route 128	27,310
Route 128	Randolph, East of Route 28	21,380
Route 9	Framingham Center	20,300
Route 28	Lawrence at Andover Line	14,060
Main Street	Woburn at Winchester	12,060
Route 128	Beverly-Wenham Line	11,520
Route 2	Acton, East of Route 27	10,450
Route 109	Medway, West of Route 126	2,950

Source: *1960 Traffic Flow Map.* Massachusetts Department of Public Works and other sources.

doubled, rising from 21,000 vehicles per day in 1951 to 42,000 vehicles per day in 1960. An even more spectacular growth occurred along the southern portions of Route 128 where in 1951 the roadway consisted of two to three lanes. After the old road was replaced by a six-lane facility traffic volumes on this section quadrupled. For example, in 1951, the daily volume on a two-lane section of Route 128 east of Route 1 was 8,400. In 1960, the same segment widened to six lanes, carried 35,700 vehicles per day.

Within the core cities, traffic volumes as high as 30,000 to 40,000 vehicles per day have been in evidence for at least three decades. Key facilities such as bridges, major arterials and other important segments of the circulation system carry these volumes regularly.

In many cases these volumes reflect existing street capacity and are not representative of higher volumes that could be carried if traffic capacity were increased through operational improvements alone. Typical average daily traffic volumes encountered on arterials in core areas are: Boston University Bridge, 35,000; Massachusetts Avenue in Central Square, Cambridge, 20,000. Many of these streets are carrying volumes that are close to or exceed their practical capacity. Table 43 shows the capacity volumes for various types of streets.

As they cross Route 128, the region's major radial arterials carry volumes generally ranging between 20,000 and 40,000 vehicles per day. For example, Route 9 carries 34,000, Route 1 north, carries 40,000; Route 1

TABLE 43

DESIGN CAPACITIES EXPRESSED AS 24-HOUR TRAFFIC VOLUMES

Area Type	Street Width 40′	20′	60′
Arterials			
Downtown	5,100	11,400	19,100
Intermediate	6,400	14,000	23,000
Outlying and Rural	7,000	15,300	23,000
	Number of 12′ lanes 4	6	8
Expressways			
All Areas	54,000	81,000	108,000

Source: *Chicago Area Transportation Study,* Volume I, Page 79.

south, 27,000; and Route 2, 21,000 vehicles per day. Beyond Route 128 volumes on these radials decline to 10,000 - 20,000 vehicles-per-day levels; the volumes level off as these roads assume the role of rural highways connecting major cities throughout the state. On routes in the areas between the major radials, lower traffic volumes prevail, in most cases running below 10,000 vehicles-per-day.

The 10,000 vehicles-per-day level is frequently the maximum volume found in many of the suburban residential communities that have experienced strong growth over the past decade and many indicate the practical capacity ceilings of local streets and highways. These suburban centers may experience increasing highway congestion as more automobiles are registered in the suburbs, and more trips are made to and from suburban origins and destinations.

In larger outlying communities such as Lowell, Lawrence, and Framingham, volumes in the centers begin to approach those encountered in the core area. For example, in the Lawrence area, volumes on key arterials are about 20,000 vehicles per day and on one bridge, daily volume reaches 35,000.

Rural roads, a large part of the road mileage in the region generally carry volumes below 5,000 vehicles per day; however, in some cases these traffic volumes are close to practical capacity. While rural roads can absorb additional traffic volumes, their contribution to relieving the region's most intricate and costly traffic problems is limited by the fact that most of these roads lie beyond Route 128, outside the more congested portions of the Boston region.

In addition to suburban population growth, future increases in traffic will be the result of increased vehicle ownership as more suburban families acquire a second or even a third automobile. It is quite likely that most travel in second and third cars will be confined to the suburban and rural portions of the region. Furthermore, many of the trips made by these vehicles will probably occur during off-peak travel periods. Thus, although increases in vehicle ownership and mileage will raise daily traffic levels on suburban roads, this may not raise the critical peak hour flows.

B. *Traffic Growth*

Before 1945 traffic volumes in the region grew at a rate under 3% per year. From the end of the war to the mid-1950's, the area experienced a much faster rate of growth; between 1950 and 1955 traffic volumes grew between 5 and 6% per year. However, the growth rate has decelerated in recent years; traffic volume in the region since 1955 has been increasing at a rate of between 3.5% and 4.0% annually.[13]

Vehicle-mileage growth in the nation has been climbing at a rate of about 4% per year. Despite the region's relatively lower rate of population expansion, the region's traffic growth is similar to the other areas. Thus, per capita travel in the Boston region appears to be growing more rapidly than in the nation. In the 1950 decade, population in the region grew at an average annual rate of less than 1% or about half the national rate. Therefore, vehicle travel per person in the region increased at twice the national average during the 1950-1960 decade. One probable cause of this large increase in per capita travel is the great amount of highway capacity that became available in the region in the 1950-1960 period which permitted a massive shift in travel habits. In the future, vehicle mileage in the core cities will probably continue to be limited by highway capacity although traffic will continue to grow at a rapid rate during the next ten years.

In addition, traffic volumes and capacities on the region's arterial street system will increase as the result of extensive improvements. The arterial street system, which was somewhat neglected during the postwar period, is now being considerably up-graded. A few examples of this upgrading are the major improvements to Blue Hill Avenue, Monsignor McGrath Highway in Somerville, traffic control measure such as at Wellington Circle in Medford, and reconstruction of Route 1 in Norwood. Furthermore, stringent enforcement of parking regulations, particularly in the core cities, will further increase traffic capacity and traffic columes.

It has been estimated that total vehicle-miles in the nation will increase from 728 billion in 1960 to 1,277 billion vehicle-miles in 1980, an increase of 76% over the 20 year period.[14] This increase averages 3.8% annually. The Boston region will probably keep pace with this projected national increase particularly in view of the additional high quality arterial and expressway mileage that will be available in the next twenty years.

Rapid transit extensions may relieve peak hour congestion in the core area but it is unlikely that they would appreciably reduce the projected growth of vehicle-mileage and traffic volumes for the region. However, rapid transit improvements would probably succeed in reducing volumes to more tolerable levels and would help to absorb future demands.

C. *Automobile Registrations*

Vehicle registrations and the persons-per-vehicle ratio[15] displays the same pattern in the Boston metropolitan area as in metropolitan areas throughout the country. In the high density core and in the outlying cities the persons-per-vehicle ratio is higher than in the low density suburban communities where car ownership is a necessity. In addition to location, ownership patterns are also affected by income. Higher income communities have lower-than-average ratios (more cars

13. Estimates based on traffic volume information issued by DPW.

14. Wilbur Smith and Associates, *Future Highways and Urban Growth* (New Haven, 1961). p. 202.

15. A measurement of vehicle ownership, arrived at by dividing population by the number of vehicles registered.

TABLE 44

1960 MOTOR VEHICLE REGISTRATION IN SELECTED UNITED STATES COUNTIES AND PERSONS PER VEHICLE RATIOS[1]

County (Major City)	Vehicle Registrations 1960	Population 1960	Persons per Vehicle
Counties in Massachusetts			
Middlesex (Cambridge)	410,581	1,238,742	3.0
Suffolk (Boston)	197,289	791,329	4.0
Worcester (Worcester)	202,971	583,228	2.9
Essex (Lynn)	195,323	568,831	2.9
Norfolk (Quincy)	182,497	510,256	2.8
Hampden (Springfield)	147,816	429,353	2.9
Bristol (Fall River-New Bedford)	139,252	398,488	2.9
Counties Outside Massachusetts			
New York (Five Boroughs)	1,431,542	7,781,984	5.6
Los Angeles (Los Angeles)	2,876,100	6,038,771	2.1
Cook (Chicago)	1,594,556	5,129,725	3.2
Philadelphia (Philadelphia)	524,327	2,002,512	3.8
District of Columbia (Washington)	272,665	763,956	2.8
San Francisco (San Francisco)	300,830	740,316	2.5
Hartford (Hartford)	253,472	689,555	2.7

1. Vehicle registrations include cars and trucks.

Source: Automobile Manufacturers Association, *Automobile Facts and Figures, 1961* (Detroit: AMA Inc., 1961), pp. 22-23, and *U.S. Census of Population, Final Report, Total United States: Number of Inhabitants.*

per family). Figure 32 shows the persons-per-vehicle ratio for communities within the region.

Table 44 shows vehicle registrations by county for the heavily populated areas in Massachusetts as well as in other parts of the nation. Suffolk County (Boston) has a ratio of 4.0, the highest persons-per-vehicle ratio in Massachusetts. A high ratio is normal in a large city where incomes are lower than in surrounding communities, where automobile ownership is more expensive in terms of insurance and garaging and where substantial mass transportation facilities are available; Boston is second only to New York in the nation in persons-per-vehicle.[16]

The persons-per-vehicle ratio in most urban areas in Massachusetts falls between 2.8 and 3.2. In urban areas elsewhere in the nation, persons-per-vehicle ratios cluster in the 2.5 — 3.0 range, indicating greater per capita automobile ownership elsewhere. Many of the nation's urban areas do not have a well developed mass transportation system and are therefore more dependent on automobile transportation than the Boston region. Nationally, the persons-per-vehicle ratio is 3.1.

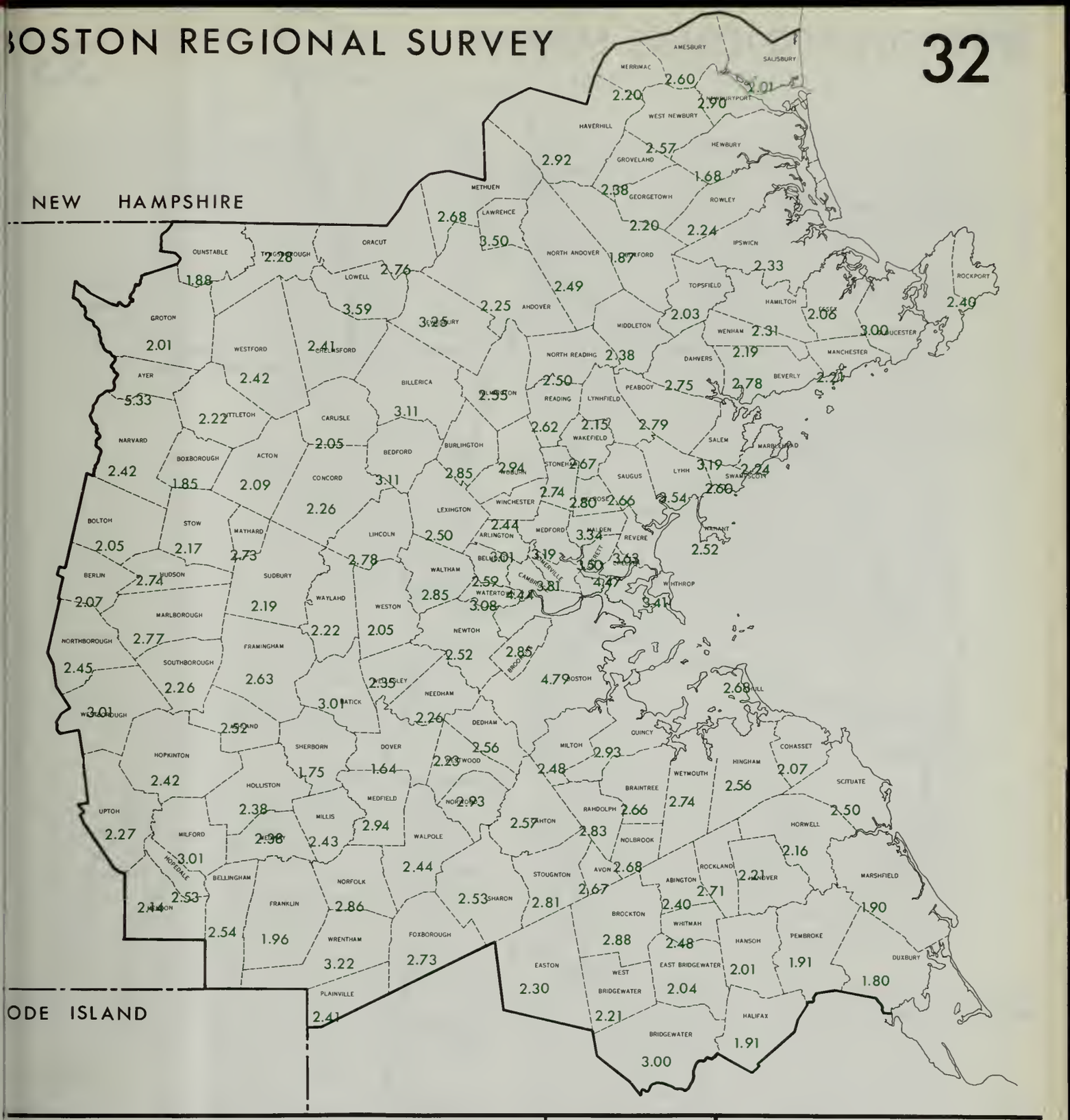
Within the region, the core communities have the highest ratios. Most communities in the region fall in the 2.5 to 3.0 but somewhat lower persons-per-vehicle ratios are evident in a ring of higher income suburban communities immediately outside Route 128.

The person-per-vehicle ratio for the region as a whole declined from 3.9 in 1950 to 3.1 in 1960. For the state of Massachusetts the comparable figure for 1950 was 3.6 and for 1960, 2.9. The lower state figures are accounted for by the low density development and lack of extensive mass transportation characteristic of much of the remainder of the state.

During the 1950-1960 period the region experienced a 37% increase in registrations as compared to a 30% gain in the remainder of the state. However, during the decade the national increase was 50%. In 1950 the region contained 781,000 vehicles as compared to 501,000 for the remainder of Massachusetts. In 1960 the com-

16. Includes New York City's five boroughs.

BOSTON REGIONAL SURVEY



VEHICLE OWNERSHIP RATIOS, 1960

PERSONS/MOTOR VEHICLE

SOURCE: U.S. CENSUS AND MASS. DEPT. OF CORP. AND TAX.

PARED FOR THE MASS TRANSPORTATION COMMISSION

Y THE PLANNING SERVICES GROUP, CONSULTANTS

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

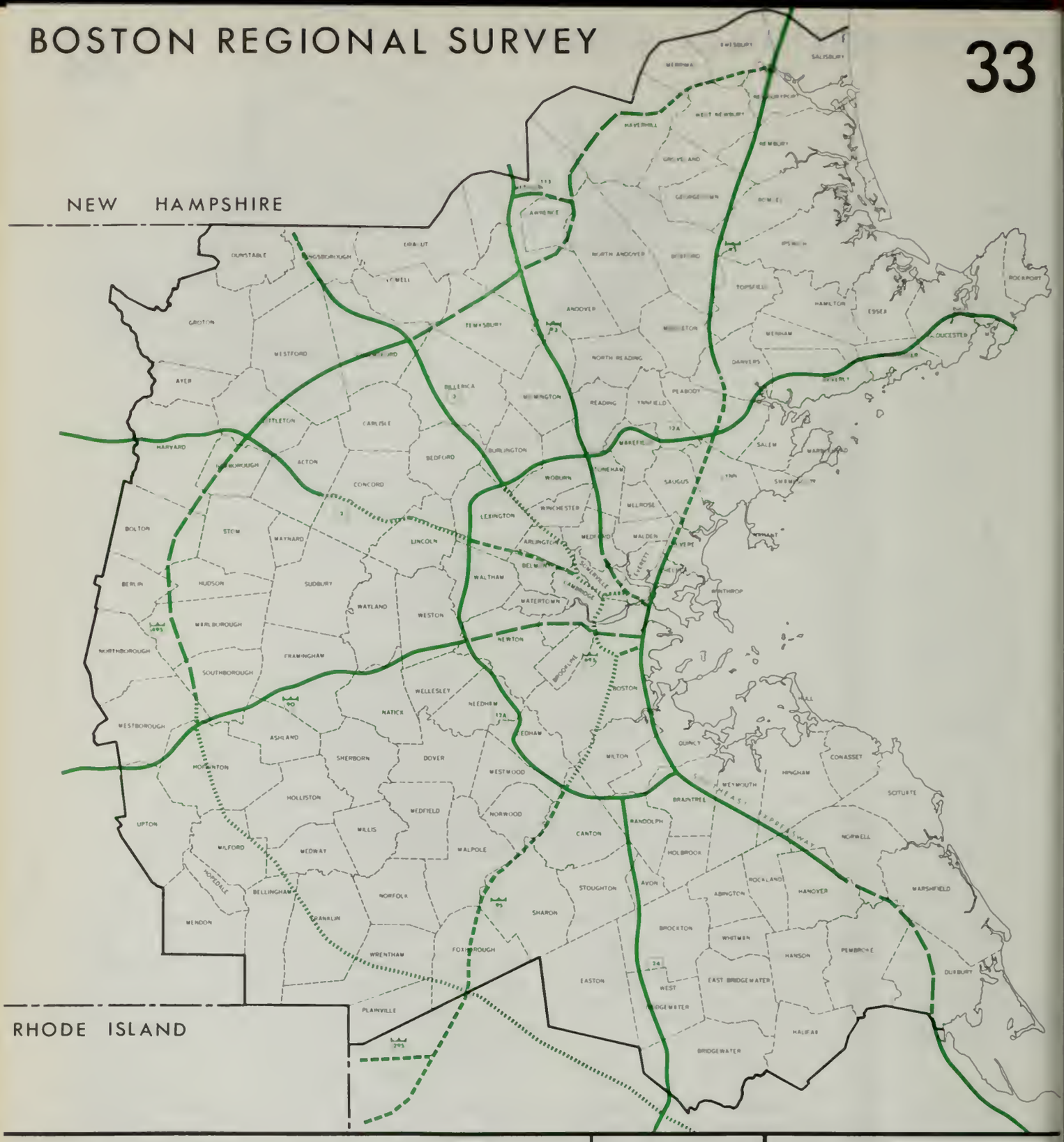
NORTH

2560 ACRES = 1 SQUARE MILES

0 5 10 MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

BOSTON REGIONAL SURVEY



STATUS OF THE EXPRESSWAY SYSTEM

- EXISTING EXPRESSWAYS
- COMPLETION BY 1965
- COMPLETION DURING 1965–1970
- COMPLETION AFTER 1970

SOURCE: CONSULTANT ESTIMATES

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
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NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION
BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

parable figures were 1,072,000 for the region and 661,-000 for the remainder of the state.

Within the region the rate of growth of vehicle registrations has varied. Among outlying central cities, fast-growing Brockton experienced the highest rate of growth during the past ten years, with a 37% increase during this period. Lawrence, whose population declined, had the lowest rate of increase during the 1950-1960 decade; its increase amounted to only 13%. During the same period registrations in Haverhill increased by 23% and in Lowell by 30%. Boston which suffered a substantial population decline nevertheless increased by 9% in registrations.

D. *Summary*

Great strides in road building volume and technique and improvements in traffic control have been overtaken by the tremendous sharp increases in motor vehicle registrations and usage. Congestion in the core cities, a subject of great concern over thirty years ago, has not been alleviated except in isolated cases. Future improvements and additions to the expressway system in the core will probably accommodate only a small portion of the total travel demand.

In addition to traffic problems in the core area, congestion has become serious in some suburban communities and in the outlying cities. Suburban traffic problems are likely to increase since a large part of the region's expected increase in vehicle mileage is expected to occur in the suburbs.

6. STATUS OF THE EXPRESSWAY SYSTEM

The expressway system, as conceived in the Master Highway Plan of 1948, has been essentially adopted as the official regional expressway plan. Only limited modifications have been made in the plan since 1948. As the region's future highway needs will change, subsequent modifications and additions to the expressway system will be needed.

Many of the expressways in the region (225 miles out of over 400 miles) are part of the National System of Interstate Highways which is scheduled for completion by 1972. Other routes which fall under other federal-aid highway programs do not have a 1972 deadline and will be built as funds become available, however, funds for these roads are limited.

Figure 33 shows the estimated completion schedule of the regional expressway system. Project completion data relating to roads that are currently under construction has been obtained from the Department of Public Works. Project completion dates for highway sections in the planning, design or study stage or which have been proposed for construction have been estimated.

A. *Route I-95 North*

A major portion of this route, 21 miles between Danvers and the New Hampshire state line, was opened to traffic in the mid 1950's. At the time of construction this segment was not specifically a part of the Interstate system and the highway geometric design standards used were slightly below those ultimately adopted for the Interstate system. Thus, while this section of the highway is an excellent four-lane divided facility, the DPW estimates that an additional $7.6 million will be needed to bring the roadway up to Interstate standards. Since the road now provides satisfactory service, the design upgrading will probably be given low priority.

North from Boston via the Central Artery, I-95 uses the Mystic River Bridge and is completed to Revere, adjacent to the abandoned Revere airport. Between this point and Danvers, only basic planning studies have been made. There is no great pressure for speedy completion since the terminal points in Revere and Danvers are connected by a four-to-six-lane divided section of Route 1. While traffic on this section of Route 1 is complicated by a great deal of commercial roadside development, advanced design features of the highway, such as left turn lanes, median strip and grade separated intersections keep capacity and operation at a satisfactory level. Construction on the final link between Revere and Danvers will probably take place during the 1965-1970 period.

B. *Route I-93*

The 24-mile link between Medford Square and the New Hampshire state line is now completed and open to traffic. In New Hampshire the road is completed as far as Rockingham Park Race Track.

Construction is now proceeding on a section of the expressway south of Medford Square near the Mystic River. It is unlikely that further inward construction will take place until the fate of the Inner Belt has been decided. Somerville, through which the final leg of I-93 would have to pass, is one of the communities that has used its veto power to prevent construction of the belt highway on the right-of-way proposed by the DPW traffic consultant.

The present terminal of the Interstate highway at Route 16 (Mystic Avenue) is convenient as a temporary ending of the road. Sections of Route 16 have been improved to handle increased volumes of traffic. Once the Inner Belt question is decided, it is quite possible that construction of the final extension of I-93 and the northern arc of the Inner Belt would proceed simultaneously. In any event completion of I-93 into Boston would probably not take place until the middle of the 1965-1970 period.

C. *Route 3*

At the present time, Route 3 is a completed four-lane divided expressway between Route 128 in Burlington and a point in Tyngsborough three miles south of the New Hampshire state line. Although this section of roadway has been open to traffic for some time, work

on the extension into Boston as proposed in the 1948 Master Highway Plan and by the DPW has not proceeded.

Since this highway would be financed under the financially limited ABC program, a start on the inward extension from Route 128 may not be made for some years.

Several studies have been made showing possible routes that might be followed for new Route 3. The recently released Inner Belt study shows several alternate routes. The one which was recommended in the Inner Belt report would utilize the section of Route 2 along the Arlington-Belmont line between east Lexington and west Cambridge.

Because of strong objections to any of the proposed alignments in this area, the heavy land-taking costs involved, and the limited amounts of funds available, the route will probably not be completed until the 1970-1975 period.

The northern end of Route 3 in Tyngsborough will probably be completed sooner than the Boston extension, since to delay construction beyond 1965-1970 might necessitate improvements to existing Route 3 in Tyngsborough that would be expensive and would later be made obsolete by the extension of new Route 3 to the Everett Turnpike.

D. *Route 2*

This route enters the region from the west as a four-lane divided expressway, reaching into the core where it connects to Memorial Drive in Cambridge. As it continues into the core the cross section becomes progressively poorer. Between the four-lane divided section which ends at the Concord Reformatory in west Concord and Route 128, reasonably high design standards prevail although there are no medians or left turn lanes.

Between Route 128 and Route 16 (Alewife Brook Parkway) in west Cambridge the road continues as a four-lane highway with several grade intersections controlled by traffic signals. The section of the road which passes through Arlington and Belmont has a median strip, carries about 30,000 cars per day, and is frequently congested during peak periods.

Plans are well under way to upgrade this section of Route 2 from a four-lane undivided highway with no access control to a limited access, eight-lane divided expressway. If the recommendations of the Inner Belt and Expressway System Report are followed, this roadway would also carry Route 3 traffic between the Arlington-Lexington line and Route 16.

Land taking along this section began in late 1962 but a final construction schedule has not been established. Construction will probably start inward from Route 128 because improvements in this area would tie in with the current widening of Route 128. Construction will probably begin in 1963 or 1964, but a final connection to the Inner Belt will be delayed until that route is built or under construction. Completion of the new expressway between Route 128 and Route 16 will probably take place in the middle of the 1965-1970 period. Between Route 128 and the Concord-Acton town line improvements will probably not be made until the 1970-1975 period.

E. *The Massachusetts Turnpike, I-90*

One of the most recently begun expressway projects in the Boston region is the twelve-mile Extension of the Massachusetts Turnpike. This expressway will extend from the terminus of the present Turnpike at Route 128 into Boston, connecting with the Central Artery in the vicinity of South Station. The highway will consist of two, three- or four-lane roadways. The eight-lane section will extend between Huntington Avenue and Center Street in Newton.

Construction of the Turnpike Extension was begun in early 1962, has proceeded at a rapid rate and the Turnpike Authority expects completion by March, 1965. The road is being built as a toll facility on the Interstate System and will be a vital segment of the region's highway network.

F. *Route I-95 South*

I-95 which is termed the Southwest Expressway will replace Route 1 to Providence as the major highway connection between New England's two largest metropolitan areas. Ultimately, I-95 will connect with the Connecticut Turnpike (I-95) via the Providence belt route (I-295) and Rhode Island I-95. This will provide an alternate southern route to New York comparable to the heavily used northern route via the Massachusetts Turnpike and Route 15 to Connecticut.

Progress along I-95 south in Massachusetts varies. Some sections are under construction while others are in the basic study phase. Construction is proceeding in a northerly direction with most progress in the southernmost portions of the route in the Attleboro area. Between the Rhode Island state line and the Foxborough-Mansfield line a ten-mile section of the road was under construction in the fall of 1962. Construction of this ten-mile section terminates at approximately the location where the Outer Belt (I-495) will ultimately connect with I-95.

From the present end of construction on I-95 to a point along the Sharon-Walpole line, an eight mile extension will be placed under construction in 1963. When this section is completed, probably in 1965, the surface of the southerly section should also be completed, opening up about 17 miles of new expressway. The end of this new construction will be at an interchange with Route 1 in Sharon, and will provide a convenient switching point for express traffic.

During the next stage of construction it is expected that right-of-way takings will begin on the section between Sharon and Route 128. I-95 for the 27 miles

between the Rhode Island line and Route 128 will probably be completed in the middle of the 1965-1970 period.

Between Route 128 and the Inner Belt, I-95 will probably be completed toward the end of the Interstate program. Several alternate locations have been studied but a number of problems remain unsolved. The large scale land taking involved in construction of the recommended route has already resulted in strong opposition from residents and neighborhood groups. In addition, the precise linkages with Boston urban renewal areas and the possible combination of rights of way for rapid transit and railroad and highway facilities have not been resolved.

G. *Southeast Expressway*

The first and only expressway to date to penetrate the core completely and tie in with a section of the Inner Belt (the Central Artery) is the Southeast Expressway. South from the Central Artery the road is completed as a six-lane divided highway as far as Route 128 in Braintree. Between this point and Route 3 near the Duxbury-Kingston Line the road is under construction with completion scheduled for the end of 1963. This section of Route 3 between the completed sections of the expressway in Braintree and Plymouth is frequently heavily congested during summer recreation peaks, a situation which will be remedied only when the final link in the road is completed. The Southeast Expressway ends in Duxbury where it connects with Route 3, but Route 3 as far as the Cape Cod Canal is built to expressway standards as a continuation of the Southeast Expressway. By 1964 an expressway route will be available from Boston all the way to Barnstable on Cape Cod.

H. *Route 24, The Fall River Expressway*

The portion of this highway (which extends south from Route 128 to Fall River and connects via Route 140 to New Bedford) within the Boston region is complete. Although Route 24 now ends at Route 128, traffic from southeastern Massachusetts has a continuous route into the core via Route 128, the Southeast Expressway and the Central Artery. When the Southwest Expressway is completed it will provide even more convenient access to Boston for Route 24 traffic.

I. *Route 128*

The first circumferential highway around Boston and one of the first in the nation, Route 128 has achieved national prominence because of the extensive industrial development which has taken place along its route. The first four-lane divided sections of the highway near Route 1 in the Peabody area were completed prior to 1948. The road was a four-lane controlled access route with some driveways and intersections at grade. As Route 128 progressed southward the new sections were built to higher design standards. In particular, the limited access law permitted the higher design standards. It became a four-lane limited access facility as far south as Route 9. Beyond this point, the design was further upgraded when traffic grew beyond all expectations on the completed portions; six lanes were provided between Route 9 and the Southeast Expressway.

When it became apparent that traffic demand had strained the road's existing capacity, widening of Route 128 was begun in 1958. By the summer of 1962, the entire section to be widened was under construction or had been completed. A completed, unobstructed Route 128 may be ready by 1964. Between Route 3-A in Burlington and Route 9 in Wellesley, Route 128 will be eight lanes wide and six lanes wide from 3-A to Gloucester. The bridges between 3-A and Route 1 in South Lynnfield will be widened to 8 lanes for future expansion. South of Route 9, the six-lane highway originally constructed will probably be adequate to serve projected traffic volumes.

J. *Route 495, the Outer Belt*

This highway along the boundary of the Boston region arcs from I-95 south to I-95 north, a distance of 88 miles. It runs in a radius of about 25 miles from the center of Boston except in the Merrimack Valley where it follows the Merrimack River and intercepts I-95 north in Salisbury; at this point it is approximately 35 miles north of Boston.

Up to the end of 1962, construction on I-495 was concentrated on the northern arc from Route 9 northerly as far as Haverhill. A four-mile section between Route 9 and Route 20 is expected to be completed by June, 1964. Between Route 20 and Route 111 in Boxborough, final designs are being prepared and construction will probably begin in 1964. Between Route 111 and Route 2, construction was under way in late 1962 and is expected to be completed by early 1964. Between Routes 2 and 3 the highway segment was completed in late 1961.

Between Routes 3 and I-93 the road is either completed or in advanced stages of construction and the section between these highways will probably be ready for use in 1963. From I-93 along the Merrimack River to Haverhill construction of bridges across the river is well advanced. Construction on the land connections was begun in late 1962 as far as Route 110 north of the center of Haverhill. Between this point and the northern terminus of the Outer Belt at I-95 in Salisbury final designs are being prepared but construction will probably not begin before 1965.

In summary, of the 61-mile northern arc of The Outer Belt, the section between Routes 2 and 3 is completed, the section between Routes 3 and I-93 will be completed in 1963, and the central Merrimack Valley section between Route I-93 in Andover and Route 110

in Haverhill will probably be completed in 1965. Route 110 between this point and I-95 north will provide reasonably good service until the final link is ready, probably before 1970. Work on the 26-mile southern arc between Route 9 and I-95 in Foxborough has not proceeded beyond the preliminary survey and mapping phase. This section of the Outer Belt will probably be one of the last projects started under the current Interstate program in Massachusetts. Completion before the middle of the 1970-1975 period is unlikely.

K. *Route 695, The Inner Belt*

This route has been the subject of a great deal of controversy. While extensive studies have been made analyzing the location, cost, potential traffic service and social and economic implications, progress on the route has been slow. Only a half-mile section of the seven-mile route is under design and a 1.3 mile section is in the survey and mapping stage. Both of these sections are in Boston. These figures do not include the Central Artery which will serve as part of the Inner Belt route.

In 1960 the State legislature passed a bill giving certain communities a veto power over the location of the route within their jurisdictions. These communities include Cambridge, Somerville, Brookline, and Boston, the four to be traversed by the Inner Belt. While Boston initially agreed to a tentative location in Charlestown and Roxbury, Brookline, Cambridge and Somerville have objected to the proposed route because of the anticipated disruptive effects on established neighborhoods and have effectively used the veto power to block construction. Cambridge and Somerville officials have protested that in its recommended location the route would require extensive land takings which would remove substantial amounts of taxable property and dislocate about 4,000 families.

It can be assumed that eventually a workable solution will be found to the Inner Belt location problem. However, as a result of delays it will probably not be completed until the 1970-1975 period, although some segments, particularly those in Boston, may be completed sooner. A mile-and-a-half section in the Charlestown area will probably be built first coordinated with urban renewal activities in that area. An additional short segment in Somerville will be needed to connect I-93 to the Central Artery. Somerville's approval of this segment would solve a major problem in this area — the dumping of express traffic on an already overburdened local street system. At the moment, however, no approval has been given by the city of Somerville for this segment of the road.

L. *Summary*

The expressway system in the Boston region as originally proposed in the 1948 Master Highway Plan and in its subsequent revisions will probably be completed by 1975. Included in this major construction effort are all segments of the Interstate system located within the region including the Massachusetts Turnpike, federal-aid primary routes 2, 3, 24, and 128 and the Southeast Expressway.

The Massachusetts Turnpike Extension will be the second expressway to penetrate the downtown Boston area, the Southeast Expressway being the first to do so. Although the widening of Route 128 will be completed prior to 1965, the other two circumferential highways, the Inner Belt (I-695) and the Outer Belt (I-495) will not be completed for another ten years.

By 1965 a series of highways composed of Interstate Routes I-93, I-495 and Route 113 will form a circumferential highway around the City of Lawrence. This circumferential highway will be the first complete ring circumferential to be built in the state, and will provide the Lawrence area with substantial advantages. However, the lack of access roads from the highway to the downtown section of Lawrence poses a serious problem for the Lawrence area.

The study of the transportation requirements of the Boston region by the Mass Transportation Commission will probably result in recommendations for additional highway facilities to be built during the next twenty to thirty years. The location of these facilities and their priority and their cost will be known after completion of the regional transportation study in December, 1964.

7. SUMMARY

Over a period of more than 300 years the regional highway system has evolved from narrow indian trails to modern multi-lane expressways. Because the highway system has developed over such a long period, its character and design differ radically from the more formal and defined system of railroads, street cars and rapid transit. The highway system has developed under public control except during the turnpike construction era of the early nineteenth century. At first, public control over highways was haphazard and minimal but as the need for highways increased toward the beginning of the twentieth century, more formal control was initiated. Subsequently, federal participation in highway construction strengthened the role of the state highway departments. In Massachusetts, as in other states, the Department of Public Works became responsible for the expenditure of all federal as well as most state highway funds. However, in addition to the Department of Public Works, other agencies, particularly the Massachusetts Turnpike Authority and the Metropolitan District Commission, also have jurisdiction over highways in the region.

A. *Finances*

Federal and state highway spending will probably continue at a high level for the next several years as construction on the Interstate system continues to be financed by federal and state gasoline taxes. While the

state tax in Massachusetts has remained at 5.5 cents per gallon since 1957, the federal tax has increased from 2 cents per gallon when the Interstate program was initiated in 1956 to 4 cents at the present time.

The Interstate Highway Program is scheduled for completion by 1972 and during the next five years, highway spending in the state will probably rise to a peak, then level off and decline as the Interstate system nears completion. While additional money may be spent on highways after 1972, it may be spent for major reconstruction of facilities on existing rights of way. Today's highways, are constructed at previously unheard of costs of $10 — $15 million per mile in urban areas, but tomorrow's highways will be even more expensive primarily because of the high cost of traversing densely built up urban areas. New highway facilities may be limited to tunnels or viaducts over existing transportation facilities such as railroads or highways.

Another major input of funds may be required for the automation of existing expressways to improve their efficiency and safety. Several experiments involving sections of radar or radio-controlled highways have been successful and new systems are continuously being proposed and tested. In this connection the state DPW has asked that the Federal Bureau of Public Roads use certain state roads as test sections for such experiments. In addition, maintenance costs, already mounting very rapidly, will also account for a larger portion of highway expenditures.

B. *Expressway Access*

Supported by federal and state funds, the expressway system has expanded rapidly. Meanwhile, arterial streets of the region which have received less financial assistance have been neglected. Access to expressways via arterial streets is a serious problem in the core cities. Even in suburban areas along Route 128, many of the expressway approaches are congested at peak hours while traffic on the expressway itself flows smoothly. This is particularly true at those interchanges which serve concentrated industrial and commercial development.

The lack of strong financial support has been only part of the problem. In many cases where expressways have been built or proposed there has been no effort to improve arterial connections to the interchanges.

C. *Arterial Street System*

While many communities have adopted comprehensive master plans which include arterial street plans there has been a lack of coordination among communities in designating these streets. The region's urban areas are honeycombed with a pattern of short-cut routes which have evolved because of the lack of an efficient arterial street program. Also, because suburban communities have neglected to designate and improve arterial routes, many narrow suburban roads experience unusually high traffic volumes. This has led to rapid deterioration of pavements designed for light traffic loads.

D. *Suburban Business Districts and Town Centers*

The rapid decentralization of retail trade during the past decade has resulted in the creation of a number of small shopping centers throughout the region. Usually located on already busy arterial streets, they have compounded suburban traffic volumes and have engendered congestion. Moreover, rapid increases in suburban population and vehicle registrations have helped to create traffic and parking problems in nearly all town centers in the region.

Construction of bypasses around town centers and other congestion points have been suggested in certain localities. The heavy expense of land takings and construction and the location problems which a bypass usually entails preclude this approach except in cases where congestion has become critical. Continued congestion at intersection points in town centers hinders the development of an efficient highway system in suburban and rural parts of the region. This is a particularly important problem since a large portion of the projected increase in the region's automobile mileage is expected to occur in the suburbs.

E. *Coordination with Public Transportation Facilities*

Highway improvements in the past have been exclusively aimed at solving highway problems. However, it has become evident that the highway system cannot be isolated and planned as a discreet transportation element, but must be approached in the context of a balance with public transportation. This balance is difficult to achieve because of competition between transportation facilities, but methods must be developed to ensure that each mode of transportation in the region is planned, designed, built and utilized to provide the service for which it is best suited. This can only be accomplished through coordinated planning and implementation among the major transportation agencies.

Interchange points between various modes require particular attention. To a degree, the region has already benefited from efforts of this type. For example, the MTA and the railroads have attempted to provide parking areas at convenient points along their routes. The New Haven Railroad's Route 128 station in Canton is an excellent example of such a combined effort.

It is likely that in the future, additional parking facilities will be provided along existing MTA routes. Moreover, rapid transit extensions require the provision of large parking lots at intermediate stops as well as outlying terminals. Furthermore, although rapid transit agencies will build these parking facilities, access to these lots must be provided by highway agencies. In order for the highways and parking to complement each other there must be a comprehensive development plan for future facilities.

F. *Highway Location in Core Areas*

As the limited supply of land in the core areas is depleted, land for expressway construction purposes is becoming extremely difficult to obtain and extremely expensive. Objections to virtually every proposed expressway are being raised by neighborhood groups fearful of the impact of six and eight lane highways.

For example, since the publication of the Inner Belt Report (September, 1962) several public hearings have been held on the proposed location of the Belt route and the Southwest Expressway. At each of these meetings strong local opposition to the expressways was in evidence.

One reason for the strong opposition is that unlike renewal programs, no relocation assistance has been available. Recent federal legislation has provided for relocation payments to families and businesses displaced by highway construction. Up to $200 would be paid to families and up to $3,000 for businesses, a schedule of payments similar to that provided under urban renewal. The DPW has filed legislation that will provide this assistance in Massachusetts.

Despite this financial assistance, the large number of families to be relocated is a serious regional problem, particularly in view of the relocation that will occur as a result of urban renewal activities. Any future highway plans must consider the requirements and effects of family relocation.

G. *Conclusions*

This chapter of the Boston Regional Survey has reviewed the development, the plans, characteristics, administration, and other elements of the highway system. As a result of this review, certain deficiencies have been noted and potential problems have been identified.

a. *Need for New Travel Data*

The most recent collection of basic travel data on a regional basis was done in 1945, immediately following the war. This data reflected wartime conditions and occurred immediately prior to the rapid unprecedented increase in automobile ownership and suburbanization following the war.

This data is extremely difficult to update. For example, the recent Inner Belt study found the 1945 data unusable as a basis for making traffic projections. A new effort is under way to collect travel data in the region as a basis for comprehensive transportation plans and to store it in a manner convenient for up-dating.

b. *Need for a New Highway Plan*

Since 1948 the region has relied upon a basic expressway plan to accommodate increasing traffic volumes. Virtually all of this plan has been adopted and the region is committed to it. Although new expressways and other traffic facilities have been proposed since 1948, none have been extensively tested to determine their feasibility. Just as the Master Plan of 1948 incorporated previous plans and new ideas into a unified plan that gave the Boston area a strong advantage when highway funds became available through the Interstate program, a new plan should be prepared to utilize future highway funds efficiently and to coordinate highway plans as part of a balanced transportation system.

c. *Arterial Street Plan*

In addition to a new plan for expressways, a system of regional arterial streets should be identified and adopted. The arterial streets should be studied and planned to provide maximum integration with the expressway system and to provide local access. The analysis of the highway system now underway will result in recommendations for improvement of the arterial street system.

d. *Financing*

The emphasis in current highway financing is on new expressway construction. While this type of construction will continue for the next decade an adjustment allocating highway expenditures must be made to provide increased amounts of money for maintenance and arterial street improvement. Many of these arterial streets are maintained solely by local funds. Unless early action is taken to improve arterials the region will find itself with an express highway system that can be only reached by congested streets and inadequate suburban highways.

e. *Highway Coordination*

Since a number of agencies are responsible for highways in the region coordination at a high level is necessary to ensure that the work of these agencies is not duplicated or in conflict. Such coordination should lead to the most efficient use of available highway funds, both for construction and maintenance.

CHAPTER FOUR — PUBLIC TRANSPORTATION

INTRODUCTION

The many uses and meanings given to the terms public transportation, mass transportation, and transit gives rise to considerable confusion. A functional rather than a descriptive definition of public transportation has been chosen for use in this study: "the movement of large groups of people in vehicles operating on specified routes and schedules."[1] A variety of vehicles and facilities provide this service in urban areas, including motor buses, trolley buses, streetcars, subways, elevated rail transit, and suburban commuter railroads.

The term "public transportation" does *not* denote the character of the agency providing the service. Public transportation is provided by both public and private agencies.

Its service is designed to satisfy primarily the aggregate demand and only secondarily the tastes and preferences of the individual rider. Large volumes and frequent service are most efficiently satisfied by scheduled service on specified routes.

For the purposes of this report, an artificial distinction is made between rail commuter passenger service and other forms of mass transportation. Bus and rapid transit mass transportation are distinguished by relatively short trips, frequent service, closely spaced stops, and relatively low prices. In contrast, suburban rail commuter service is characterized by longer trips, less frequent service, greater distance between stations, and higher fares. Nevertheless, the railroad is a common carrier accommodating mass origins and destinations and must be considered as an integral part of the regional public transportation system.

1. THE HISTORICAL BACKGROUND

A brief review of historical highlights in the development of public transportation in the Boston region helps in understanding the present public transportation system. A century of complex and rapid technological, social, and economic changes can be summarized in terms of a few principal findings.

A. *Boston Has Been a Leader in Transportation Innovations*

Historically, the Boston region has been a leading innovator in each new technical phase of mass transportation. With land at a premium in its waterlocked central area, Boston closely followed New York in the introduction of the omnibus and horsecar, the forerunners of modern bus and rapid transit. The omnibus — a horse-drawn bus — made its first appearance in Boston in 1826, providing service every two hours to Roxbury. Its successor was the horsecar. Running on its own right-of-way, on iron wheels over iron rails, the horsecar was faster and more comfortable than the omnibus. It was introduced in the 1850's, the first lines running from Cambridge to Somerville, and from Meeting House Hill in Dorchester to the Roxbury line. Although the horsecars were cheaper than the omnibus, because of greatly increased passenger volume, horsecar lines were a financial success. The horse was replaced by electricity: In 1900, Boston's large urban street railway system was electrified, leading the way for the acceptance of electric railways in other parts of the country. Figure 34 shows the extensive street railway network in 1900, and distinguishes the Boston Elevated Company lines from lines of other major companies which also served the central areas of the region.

Electrically powered vehicles enjoyed a number of technical advantages over the horsecar. Electric traction doubled the available travel radius, considerably increased the average speed of passenger service, and reduced the cost per passenger mile.

Another example of Boston's transit leadership was the building of the Tremont Street Subway in 1897, the nation's first. Figure 35 illustrates the early construction as well as the later extensions of the rapid transit system.

B. *The Boston Region Has Been a Leader in Mass Transportation*

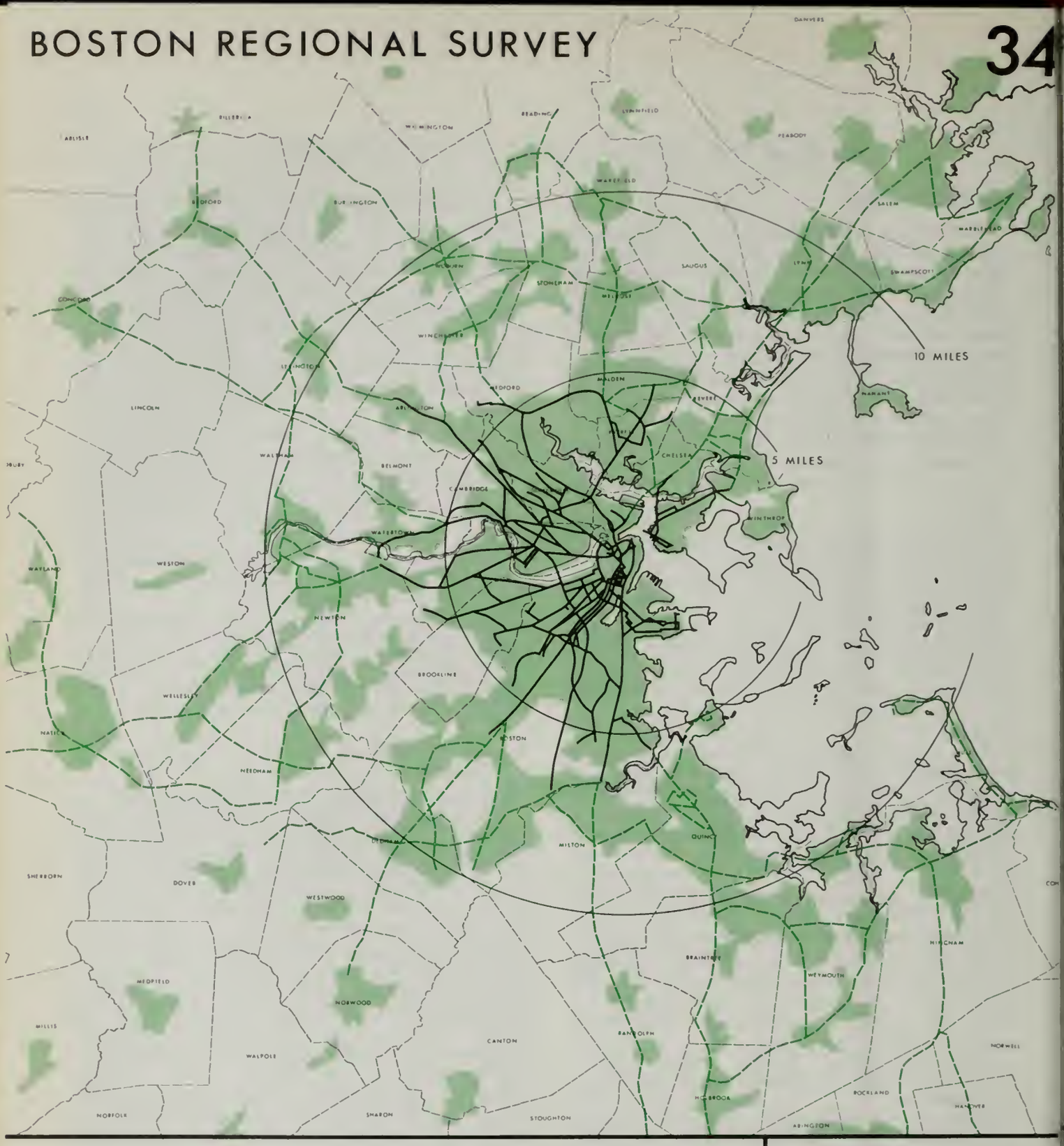
Boston was a leader not only in the introduction of new means of transportation, but also in adopting technical innovations more extensively than other areas. By 1887 Boston operated the largest horsecar railway system in the nation and in 1903, Massachusetts possessed the most extensive mileage of electric street railway in proportion to area and population of any state in the country. A large part of this mileage radiated from Boston to all parts of eastern Massachusetts. The coverage of the electric street railway system in southern New England reached its peak in 1912, and is illustrated in Figure 36 which also shows the rapid decline in track mileage by the mid-1930's. Expansion was accompanied by consolidation and large scale investment. By 1911, the region's Bay State Street Railway Company system was the nation's largest street railway system under one management. By 1925, the Boston Elevated had the largest investment per rider of any transit system in the country.

C. *The Growth of the Region's Mass Transit System Was Piecemeal*

Boston's present mass transit system is based to a large extent on the speculative ventures of individual entrepreneurs five to six decades ago. It did not grow out of a comprehensive, rational plan and was by no

1. Wilfred Owen, *The Metropolitan Transportation Problem* (The Brookings Institution, Washington, D.C., 1956), p. 4.

BOSTON REGIONAL SURVEY



STREET RAILWAYS, 1900

BOSTON ELEVATED

OTHER LINES

URBAN DEVELOPMENT, 1900

NORTH

1 SQUARE MILES

0 1 2 3 4 5 MILES

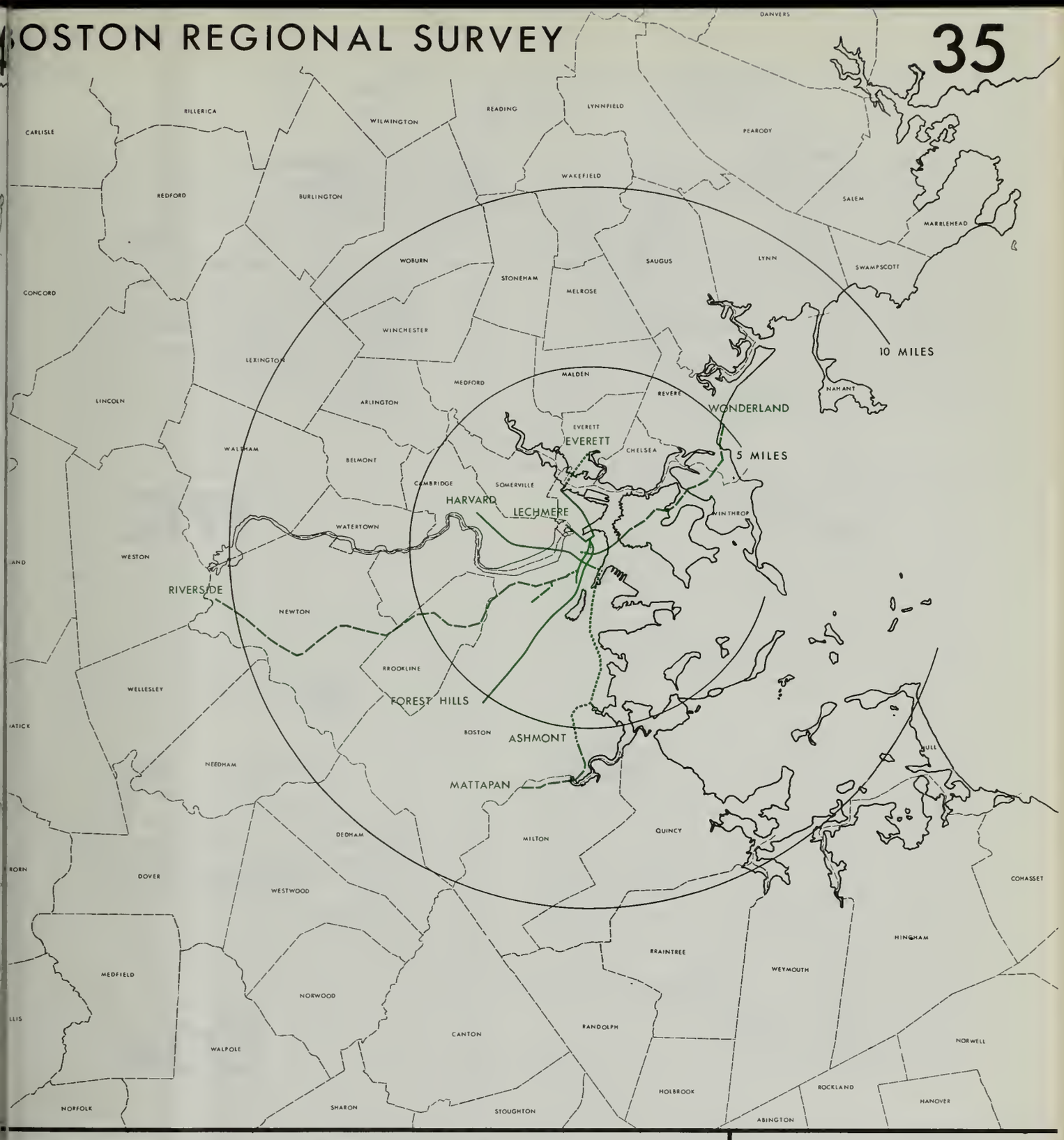
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HOUSING ACT OF 1954 AS AMENDED

BOSTON REGIONAL SURVEY

35



GROWTH OF RAPID TRANSIT SYSTEM

——— BEFORE 1917

..... 1917–1930

– – – – AFTER 1930

NORTH

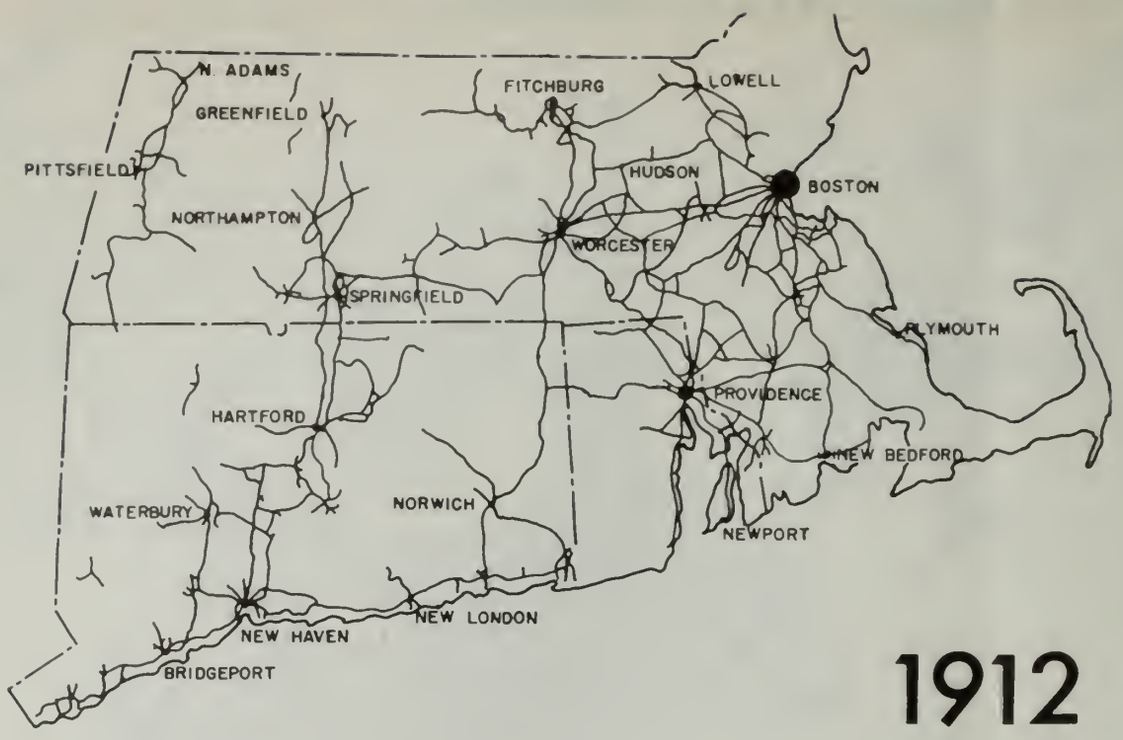
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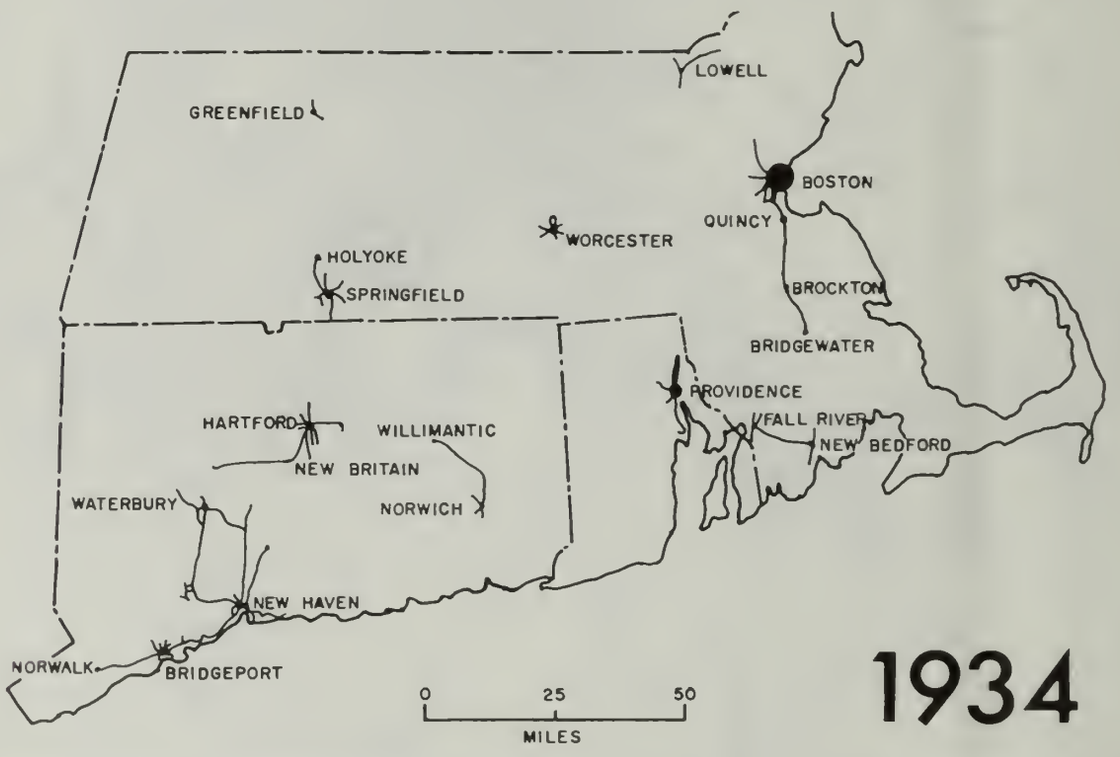
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1912



1934

STREET RAILWAYS IN SOUTHERN NEW ENGLAND, 1912 AND 1934

SOURCE: HEALY, KENT T., DEVELOPMENT OF TRANSPORTATION IN SOUTHERN NEW ENGLAND, 1934.

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means based on prudent economic evaluation. Early financial successes led to overdevelopment, including duplication of routes, poor connections between lines and construction of trackage in areas with inadequate market potential.

One source of financial problems was an inflexible rate structure. During a period of rising costs, the low five cent fare was maintained and from 1910 to 1920 smaller companies went into bankruptcy while larger companies abandoned many lines. By 1918, the cumulative effects of past mistakes and growing automobile competition resulted in bankruptcy for the two major regional transit companies, the Boston Elevated and the Bay State Street Railway. The Elevated's financial ailments were not to be cured by public control. Five of the twelve years under public supervision (1918-1930) of the Boston Elevated were deficit years. Moreover, after 1930, the Boston Elevated (later the MTA) experienced yearly deficits interrupted only by abnormally high transit patronage during World War II when gasoline and tire rationing caused a temporary decline in automobile competition.

Since 1930 the bus and automobile have had a great impact in the transit market. The interurban portion of the street car system in the outer areas has been entirely replaced by bus routes, and even in the inner area a considerable number of bus routes have supplanted streetcar service.

D. *Mass Transportation Has Shifted from Private to Public Ownership*

Transit operations were transferred from private to public ownership when transit became unprofitable. Private owners financed the first stages of development when companies were assured a lucrative near-monopoly of urban travel. In the belief that extensions into new territory rather than equipment improvement was the key to higher revenue, transit companies attempted to maximize returns by pushing lines into thinly populated territory[2] while allocating funds for improvements to equipment and facilities reluctantly and only after considerable public prodding. An early example of the inability or reluctance of private owners to provide adequate facilities occurred when street railway companies showed no disposition to construct a rapid transit line. Sentiment in favor of rapid transit led to the formation of a public authority — the Boston Transit Commission — which was created by the legislature in 1894 for the specific purpose of building a subway under Tremont Street. After it was built, the subway line was leased for operation to a private company.

By 1918 the widespread dependence on mass transit and the obvious shortcomings in service and equipment led to increasing public concern over the transit system. When private owners pleaded inability to improve operations because the system had become unprofitable, government began to exercise increasing control over private management. A Public Control Act passed in 1918 was designed to assure continuance of transit service to the 14 cities and towns served by the Boston Elevated Company. (This is the same service area as the present Metropolitan Transit Authority District.) The Act provided for a Governor-appointed Board of Trustees to exercise control over the Boston Elevated Company, guaranteed annual returns to stockholders, and provided for the issue of preferred stock for capital expenditures. Any deficit was to be assumed by the 14 cities and towns of the District in proportion to their share of passenger traffic.

It was hoped that this was only a temporary measure but, because of continuing financial difficulties, in 1930 public control was extended by a referendum. A further legislative act in that year created the Boston Metropolitan Transit District, comprising the same 14 cities and towns, with a governing Metropolitan Transit Council. The Boston Metropolitan Transit District was given the right to issue bonds, and the Council was given power to adjust fares. It was clear by this time that a return to profitable private operation of transit service was impossible primarily because the public had become accustomed to a relatively high level of service at low fares.

Inauguration of public control and ownership of transit coincided with a fundamental change in the nation's transportation habits. The private automobile, with its flexibility and convenience, effectively challenged the supremacy of mass transportation and caused a continuing decline in patronage reversed only in the war period. Deficits became chronic and grew in size. The acute financial problems of the Boston Elevated Company were carefully analyzed in the 1945 and 1947 reports by the Metropolitan Transit Recess Commission (Coolidge Commission).[3] One of the recommendations contained in the reports called for public ownership, as a last resort. The Act of 1947 established public ownership in the form of the Metropolitan Transit Authority. However, subsequent experience proved that public ownership was not in itself the remedy for the basic weakness of the transit system: its inability to cover the cost of service in the face of steadily declining patronage.

E. *Mass Transportation Has Affected the Region's Structure and Growth*

Each phase of mass transportation innovation and extension left enduring effects on the region. Horsecars and omnibuses provided the basis for the first commuting suburbs for the wealthy. Low fare electric railways permitted people with lower incomes to live at some distance from their place of employment.

2. Some lines were designed by their owners to spur real estate development; there are instances in which operating losses in transit were more than repaid from real estate ventures.

3. Commonwealth of Massachusetts, *Report of the Metropolitan Transit Recess Commission* (1945) (Boston, 1945), and *Report of the Metropolitan Transit Recess Commission* (1947), (Boston, 1947).

Rapid transit stimulated high density residential, commercial, and industrial development in the region's core. Self-powered buses extended mass transportation to low density suburban areas.

The transit system helped provide the foundations for large scale suburban growth. Whereas the earlier railroad expansion helped to establish small urban centers near suburban stations, the construction of the electric street railway provided the basis for the first wave of mass suburbanization.

Electric street railroads both fostered and required adjacent high density development since the cost involved in construction limited geographical coverage. Consequently, high density tenement districts were built within easy walking distance of transit lines and became closely associated with public transportation.

Contacts increased between rural and urban centers as well as between individual urban settlements with the spread of low cost mass transit. Transit permitted industry and large offices requiring substantial numbers of female workers to expand their labor market; growth of labor-oriented activities was accelerated at points which enjoyed good public transportation access. Interchange between outlying satellite communities and Boston also increased, laying the groundwork for growing regional interdependence.

Boston, the largest of the region's urban centers, was located at the focal point of the electric railway system, and concentration and expansion of activities was greatest and most rapid in the city particularly in its downtown area.

The pattern of regional land use was shaped decisively by the developing mass transportation system, although other factors such as demographic characteristics and economic patterns and trends also influenced urban growth. Some degree of suburbanization would have taken place in any case to accommodate a growing population, but it is reasonable to assume that the extent of urban spread prior to the mid-1920's would have been far more limited in the absence of an efficient mass transit system.

2. ORGANIZATION AND FINANCING OF THE METROPOLITAN TRANSIT AUTHORITY

A. *Organization of the MTA*

The Metropolitan Transit Authority is the region's most important public transportation agency with total assets of approximately $150 million. The MTA serves a 123 square mile area with a 1960 population of slightly under 1.5 million persons. The transit service district consists of the City of Boston plus 13 other cities and towns outside the corporate limits of the city, essentially the same pattern as in 1918.

The MTA deficit, which must be borne by the member communities of the district, adds to the real estate taxes of municipalities that already rely very heavily on this source of income. The unpredictable nature of the deficit introduces an element of fiscal uncertainty into community fiscal planning. Since 1950 the annual deficit assessed on the 14 cities and towns in the district has increased almost every year, despite a substantial cutback in employment.[4] In 1960 the deficit was just over $21 million, the highest in MTA history. At least part of the reason for the rising deficit is clear: MTA ridership decreased by approximately 35% between 1950 and 1960 while operating expenses and fixed charges increased by almost the same percentage. Fare increases and reductions in services resulted in a substantial decrease in the MTA deficit in 1961, but if the decline in patronage continues, the financial problem will become increasingly grave.

Two important aspects of the MTA are its administrative organization and the method by which its operations are financed. Each of these aspects is the result of a complex history; each has been criticized as being responsible for the system's current problems.

The MTA is a political subdivision created by the Commonwealth in 1947 for the purposes of purchasing the properties and interests of the Boston Elevated Railway Company[5] and represents the 14 cities and towns served by the old transit system.[6] The MTA is a corporate political body which can sue, prosecute, and defend itself in legal proceedings, acquire property by eminent domain with the approval of the General Court, enter into contracts without legislative approval (except those dealing with new or extended transit lines), and borrow money.

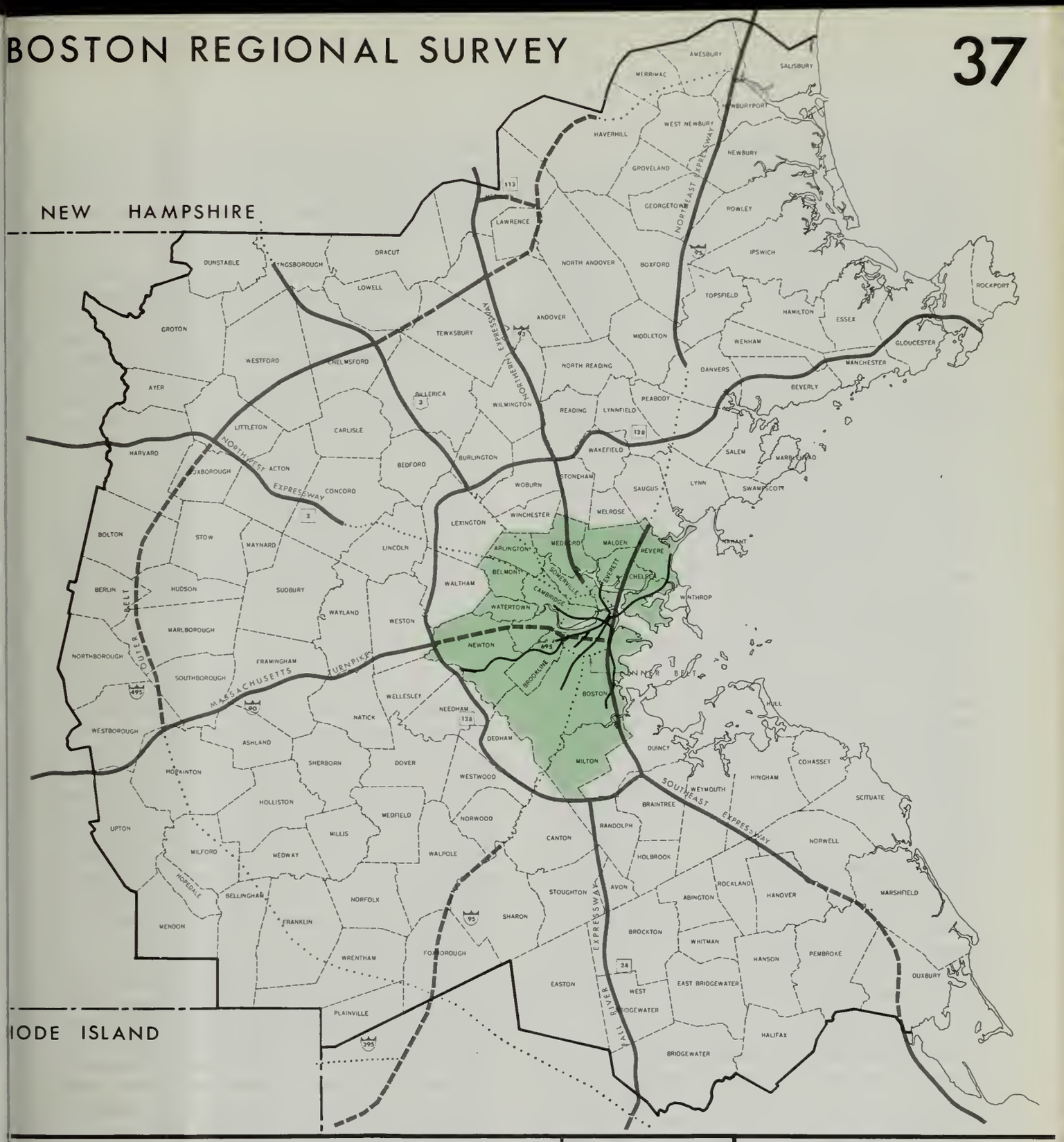
a. *Board of Trustees*

A three-member *Board of Trustees* has responsibility for managing the MTA. Members are appointed by the Governor with the advice and consent of the Executive Council for six-year, staggered terms. The Chairman of the Trustees is designated by the Governor without approval of the Executive Council. All three Trustees must live in the MTA District. One must be experienced in transportation, one in labor relations, and one in administrative and financial matters. The Trustees have the power, with the approval of the Advisory Board, to appoint a *General Manager*. The manager may be removed by the trustees without approval of the Advisory Board. The trustees are empowered to appoint and remove other MTA officers and employees and to determine the duties and compensation of personnel.

4. In some respects, 1950 is not a good base for trend comparisons in MTA operations, since a fare increase immediately preceded it, a major refunding of MTA debt occurred during the year and a revised depreciation schedule was introduced. However, some atypical qualities can be found in almost any year of MTA operations. 1950 is useful for comparison purposes because it was the most recent year in which the MTA nearly succeeded in eleminating the annual deficit. After 1950 deficits tended to increase in almost every year except when fares were increased.
5. Two basic statutes govern the organization of the MTA: Acts of 1947, chapter 544 and Acts of 1952, chapter 404. The latter relates specifically to the Advisory Board.
6. The Communities in the MTA District are: Arlington, Belmont, Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford, Milton, Newton, Revere, Somerville, and Watertown.

BOSTON REGIONAL SURVEY

37



METROPOLITAN TRANSIT AUTHORITY SERVICE AREA

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 = 2560 ACRES
SQUARE MILES

0 5 10 MILES

PARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

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b. *MTA Advisory Board*

The *MTA Advisory Board* consists of the City Manager, Mayor, or Chairman of the Board of Selectmen of each member community. Each member of the Advisory Board has a number of votes proportional to the share of the MTA deficit paid by the individual city or town, as determined by a passenger origin and destination survey conducted in 1940. Under this procedure, the city of Boston has 64.3% of the votes on the Board. The Advisory Board's consent must be obtained by the Trustees in all matters pertaining to changes in fares. The Board may consult with the Trustees on the nature and scope of MTA service, but changes of this nature are not subject to Board approval.

c. *Extension of the MTA*

The MTA transit system may be extended beyond the present district by two procedures. In the cumbersome "home rule" procedure, the MTA Trustees submit plans and specifications for the extension to the State Department of Public Utilities. The DPU gives notice of a public hearing which must be held within 60 days of the date of notice. The DPU must then approve or disapprove of the proposal based on evidence derived from the hearing. If it grants approval, the Department officially notifies the mayor or selectmen of the community or communities concerned. The mayor or selectmen must then call a special municipal election within 60 days of such notification. If such an election is not held, the extension is considered approved. If the extension is approved by default or by a favorable vote, the Department of Public Utilities submits to the legislature for action the recommendation for extension, a statement of the results of the local referendum, and drafts of proposed legislation.

Antagonism of communities outside the MTA district to extensions of the MTA has made application of the home rule procedure politically unfeasible. In a referendum vote under the home rule procedure in 1948, Quincy and Braintree decisively voted down a proposed extension to the South Shore by a margin of six to one.

d. *Extension of Rapid Transit Service*

Another procedure for extension outside the district involves action by the legislature without concurrent approval from local communities. A recent instance of direct legislative action was the creation in 1961 of the South Shore Transit District, comprising Quincy, Braintree, Weymouth and Hingham, as an independent transit agency to take over the Old Colony line of the New Haven Railroad.

B. *Financing of the MTA*

The Board of Trustees is responsible for the administration of the MTA's financial affairs except for certain aspects of debt management which are the function of the Boston Metropolitan District. The trustees must maintain accurate financial records that are audited annually by the State Auditor, and must prepare periodic annual reports and financial statements to the General Court, the Governor, the Boston Metropolitan District Trustees and the State Department of Public Utilities.

The MTA is empowered to borrow money with approval of the Department of Public Utilities by selling MTA notes to the Boston Metropolitan District trustees. The Boston Metropolitan District is an agency representing the communities served by the old Boston Elevated Company and the MTA. The District obtains capital to purchase MTA notes by selling tax exempt bonds and notes to the public. Amounts and terms of borrowing for capital expenditures are designated by specific laws. Borrowing for the purchase of equipment is subject to a $16.4 million debt limit that can be exceeded only with the permission of the General Court. Within these restrictions, the terms and interest rates of MTA and Metropolitan District bonds are determined by the Boston Metropolitan District Trustees with the approval of the Department of Public Utilities. The District also lends money to the MTA for short term operating requirements.

The MTA must pay state motor vehicle excise, license, and fuel taxes. Elimination of these taxes has been suggested as a means of improving the Authority's financial position. The MTA is exempt from local real estate taxes, betterment assessments, and other state and local excise and license taxes, and interest on its bond issues are not subject to state or federal income taxes.

The MTA trustees determine passenger fares subject to the approval of the Advisory Board and the State Department of Public Utilities after due notice and hearing. Fare increases are limited in any one year to revenues which cover the annual cost of service plus $2 million.[7] Any surplus above the annual cost of service is to be placed in a reserve fund for the purpose of "making good any deficiency in income."[8]

The reserve fund, managed by the trustees, was originally endowed with $2 million from receipts of bonds that were issued in creating the MTA. When the funds in reserve prove inadequate to cover deficits, as has been the case ever since the MTA was established, the MTA notifies the State Treasurer and the amount is advanced by the Commonwealth. The amount of the deficit is then assessed on the 14 communities and towns in the district in direct proportion to their use of the system as determined by a 1940 origin and destination survey. Originally, it was planned to conduct such surveys periodically, and the trustees authorized such a survey in 1956 and apportioned the 1955 deficit on the basis of the 1956 count. However, the legislature at

7. The cost of service includes: operating expenses of the authority and Advisory Board taxes, rentals, debt service, depreciation allowances approved by the DPU, personal service, pensions of employees, last annual deficit of the Boston El, cost of transit extension and improvement, and legal costs.
8. Acts and Resolves 1947, Chapter 544, s. 13.

this time embodied the 1940 traffic count into law. This method has been attacked as outdated and unjust and various schemes which would establish community shares on the basis of percentage of total MTA district population, on the basis of assessed valuation, or MTA route miles, have been proposed as substitutes.

A geographical redistribution of the deficit has been proposed as another means of sharply altering the apportionment of the deficit among individual communities. It has been proposed that the MTA district be expanded to include a number of fringe communities located close to, but outside the present boundaries of the MTA service area. All of these alternatives have met strong opposition from communities whose taxes would be increased by a change in the present formula.

a. *Revenue Amounts and Sources*

MTA total income declined early in the 1950-1960 decade, then increased slightly during the middle of the period, but resumed its decline in the last years of the decade. Losses in the number of revenue passengers was the major cause of reduced income. Decreased passenger usage was offset in part by fare increases, but higher fares led to further declines in patronage.

b. Fare Structure

An inflexible fare structure has traditionally tended to produce underpriced service; strong local sentiment made fare increases politically inexpedient for long periods of time. However, increased automobile competition, declines in transit patronage, and rises in operating costs and fixed charges have periodically forced reconsideration of the fare structure.

Under pressure of mounting deficits, the MTA has made four fare changes since the date of its inception in 1947. At present (February 1963) there are no transfer privileges between surface and rapid transit lines. Surface rides cost 10 cents, a reduction from previous years, while rapid transit rides, including the streetcar subway and regular rail rapid transit, cost 20 cents. For longer trips that combine both surface and rapid transit lines the total fare is 30 cents, or, if surface lines are used at each end of the trip, 40 cents. On the Highland Branch extension, the longest single rail rapid transit route in the system, a zone fare has been instituted with the maximum fare set at 40 cents. For some years, the MTA charged a single fare for a ride over the entire system. This practice had the effect of penalizing the short trip rider in favor of passengers making longer trips. With the withdrawal of free transfer privileges and the introduction of a fare differential for surface and rapid transit rides in 1961, the fare structure has approached a modified zone system that more truly mirrors costs. Higher fares for rapid transit trips, which are generally longer and speedier than shorter feeder surface trips, is the usual practice in transit systems.

TABLE 45

TRENDS IN MTA FARE STRUCTURE, 1947-1961

Year	Type of Transit		
	Surface	Rapid Transit	Combination
1947	$0.05	$0.10	$0.15
1950	0.10	0.15	0.15
1954	0.15	0.15	0.20
1961	0.10	0.20	0.30-0.40

Source: MTA, *Annual Reports.*

Zone fares have certain disadvantages. A true zone fare system may be costly to administer in terms of personnel and may discourage patronage. For example, the tenfold increase in Highland Branch riders over previous commuter railroad patronage has been attributed to the relatively cheap flat rate of fare on the line when it originally opened. The fare was in line with prevailing system fares, but in terms of length, a ride on the Highland extension was a bargain compared to service elsewhere in the system. With the inauguration of a zone fare system, the volume of passengers travelling on the Highland Branch has declined somewhat, but the original low fare may have been important in building up a large ridership.

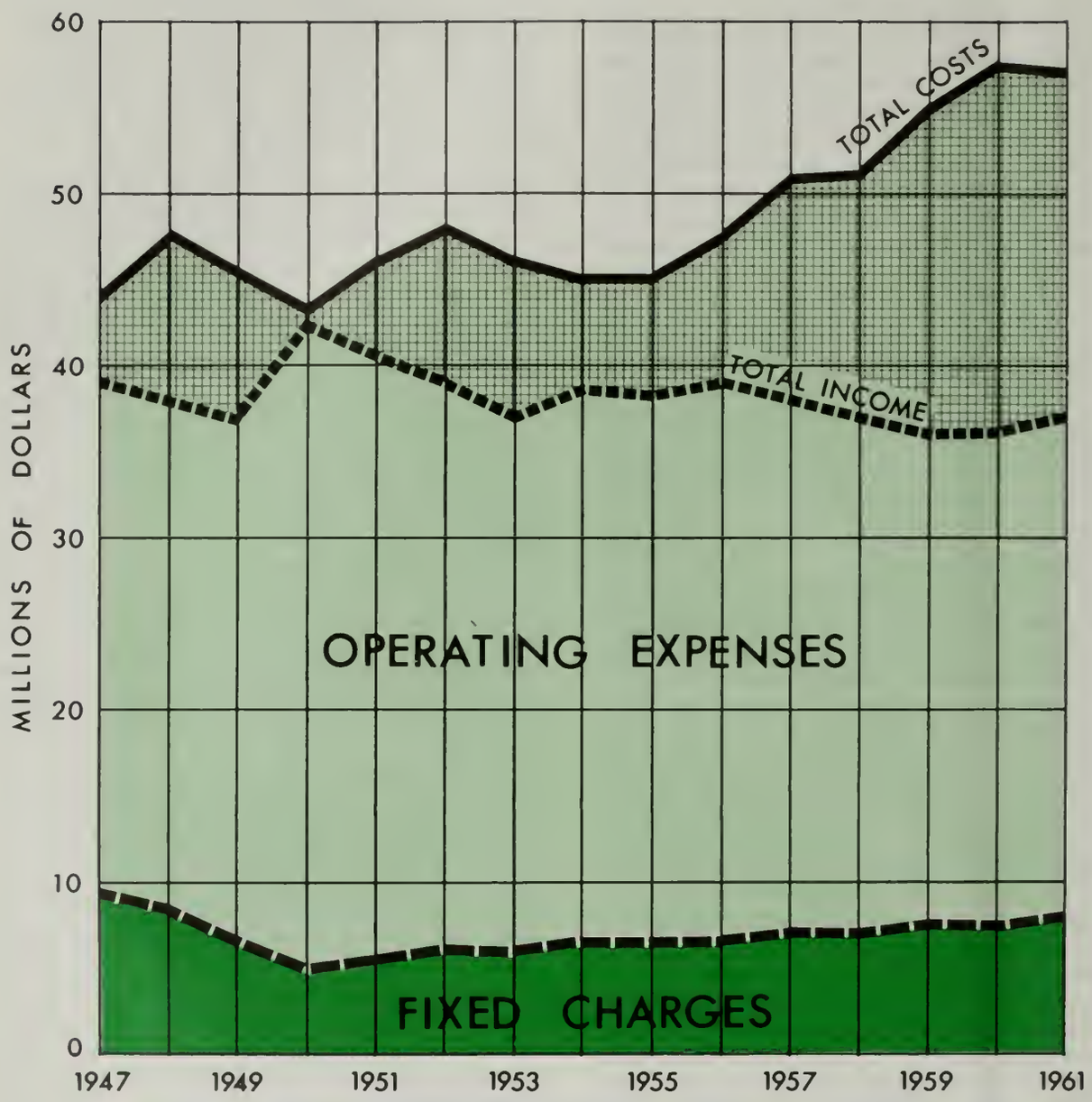
The only example of a premium express fare in the MTA system was a 25 cent express bus service from Chelsea to downtown Boston, which was discontinued shortly after a fare increase (plus ending of free transfer privileges). Express service results in better equipment and manpower utilization and less equipment depreciation, but the low passenger turnover makes a higher fare necessary.

Passbook fares which allow a special low levy for the peak hour riders are not used in the system. The relative merit of this type of fare is subject to debate.

It is difficult to make direct comparisons between fares on the MTA system and those on transit lines elsewhere in the nation, but the MTA's pattern of rapidly rising fares over the past decade has many parallels elsewhere. In 1951, 69% of the transit systems charged 10 cents per ride, but as of 1961, 72% charged 20 cents or more.[9] Considering the size of Boston's transit system, and its limited coverage within the region, the MTA fare is probably relatively high, compared to charges in other major cities.

Raising transit fares to meet the increasing cost of service risks the danger of pricing transit out of the transportation market. In general, raising fares has not been an effective long term method of raising revenue since higher fares result in diverting transit riders to alternative modes of transportation, particularly automobiles. For example MTA fare increases in 1949 and 1954 caused substantial decreases in patronage with the result that revenue increased only slightly.

9. "Fares and Fare Collection." *Metropolitan Transportation* (Vol. 58, No. 1, January, 1962), pp. 30-38.



M.T.A. FISCAL TRENDS, 1947–1961

DEFICIT

SOURCE: M.T.A. ANNUAL REPORTS

TABLE 46

MTA COST OF SERVICE, 1950 and 1961

	1950		1961	
	Amount ($000's)	%	Amount ($000's)	%
Operating Expenses	$38,285	88.5%	$49,505	86.4%
Wages and Retirement Fund	29,292	67.7	40,572	70.8
Other	8,993	20.8	8,933	15.6
Fixed Charges	4,957	11.5	7,825	13.6
Total Cost of Service	$43,242	100.0%	$57,330	100.0%

Source: MTA, *Annual Reports.*

c. *Cost of Service*

The total cost of MTA service has risen by $14 million — 30% in the past 11 years. The two principal components of cost of service are operating expenses and fixed charges. *Operating expenses* are the largest and most important components of service cost and are directly related to the service and patronage demand on the system. *Fixed Charges* are a steadily rising but less important element of total cost of service, and are relatively independent of fluctuations in level of service.

d. *Operating Expenses*

Labor expenses, by far the most important single element in operating expenses, have become increasingly important during the 1950-1961 period, as can be seen in Table 46. While other components of operating cost have declined about 5% during this period, labor costs have increased about 3%. Trends in Boston parallel national trends toward an increasing proportion of the transit dollar being allocated to labor.[10] Labor costs include wages directly to employees plus indirect fringe benefits such as insurance, compensation, etc. Wages paid to employees are the major labor cost and account for most of the increase in labor costs.

Table 47 reveals that economies obtained from a 30% reduction in the total number of employees during the 1948-1961 period were more than offset by an increase of 38% in the yearly payroll. Only two-fifths of the total personnel employed in 1961 were directly engaged in providing transportation service. The remainder were either indirectly associated with transportation or were administrative personnel. Each of the two categories of personnel declined by about 30% in the 1948-1961 period, the decline rate being slightly faster for personnel directly engaged in providing transportation service.

e. *Fixed Charges*

When the MTA bought the Boston Elevated system from its private owners, the Boston Metropolitan District issued bonds for the amount necessary to cover the purchase price of over $20 million.

In 1949, the MTA was permitted to exclude three items from the cost of service: principal payments on the subway purchases and on new construction bonds, interest on deficit advances made by the State Treasurer and the cost of operating the Boston Metropolitan District. Thus, certain fixed charges are excluded from the reported MTA deficit although they are still assessed directly on the 14 communities within the district.

MTA fixed charges represent mainly the principal and interest payments on past and current expenditures. In 1960, the MTA owed a total of about $141 million. Based on type of expenditure, the total debt can be divided into four distinct parts.

The *original debt* was consolidated for long term refinancing into a single $70 million bond issue in August, 1949. This includes the total outstanding debt in-

10. *Loc. cit.*

TABLE 47

MTA EMPLOYMENT AND TOTAL WAGES, 1948-1961

	1948		1961		Change, 1948-1961	
	Number	%	Number	%	Number	%
Total Employees	8,496	100.0%	5,850	100.0%	—2,646	—31.1%
Transportation						
Passenger Service	3,594	42.3	2,389	40.8	—1,205	—33.5
Other	4,902	57.7	3,461	59.2	—1,441	—29.3
Total Yearly Payroll						
(in $millions)	$26.9	—	$38.4	—	+$11.5	+38.3%

Source: *Report of the Joint Legislative Committee on Transportation.* (House No. 3400, January, 1962), pp.40-41, and MTA, *Annual Reports.*

curred by the Boston Elevated prior to 1947, and also the purchase price paid by the MTA for Boston Elevated stock. The original debt is inherited; it is the cumulative product of operating policies and management practices of previous private owners. The large size of the original debt makes its annual payments larger than any of the other payments made on the total funded debt. The total cost of interest on this portion of the debt was over $2 million in 1960. The MTA has retired $1 million of original debt annually since 1947, leaving almost $60 million to be paid as of 1960.

The subway debt arose from the $40 million paid to Boston for purchase of city-owned subways in 1949. It is the second most important portion of MTA fixed charges. About $500,000 of this debt has been retired annually, and the balance now stands at about $34 million. Including interest payments, total annual payments on subway debt were over $1.75 million in 1960.

The *new construction and off-street parking debt* consists of all the debt incurred by the MTA since August, 1949 for construction of transit facilities and off-street parking. Total annual payments on this portion are considerably lower than on any other portion of the total funded debt. In 1960, annual payments on this item amounted to almost $500,000, including about $400,000 for principal and $100,000 for interest. The extension and alteration of the East Boston rapid transit line and the Highland Branch extension account for the major part of the over $30 million in debts of this type incurred since 1949. Only about $2 million of this total has been paid.

The revenue equipment debt consists of bonds issued to purchase and make improvements to rolling stock. Acquisition of new rapid transit cars and replacement of old buses by new diesel buses account for a major share of the over $27 million borrowed for this purpose since 1947. In 1960, the amount still owed was over $18 million and the annual payment amounted to about $1.5 million, including just over $1 million for principal and the remainder for interest.

Taxes, the Cambridge subway rental, and insurance expenses of over $1 million in 1960 comprise the remainder of fixed charges. If both the original debt and the subway debt are considered as legacies from past operation, then only about half of the total fixed charges as of 1960 can be properly considered as incurred directly by the MTA. Equipment modernization accounts for the larger part; extensions and parking lot construction account for only a minor part.

C. *The MTA Deficit*

It appears that the prevailing opinion in the Boston area is that the annual transit system deficits arose partly from the problems inherited from an overspeculative private management and partly from mismanagement of the system. It is widely believed that the deficit problem can be solved through application of sound administrative and accounting procedures. In the past fifteen years a wide range of reforms have been suggested. These include an increase in or subsidy for children's fares, requirement of an annual budget, elimination of state fuel taxes and other fees, discontinuance of poorly patronized routes, elimination of alleged featherbedding practices, increasing the responsibility of the general manager, elimination of state interest charges on borrowed money, changing the method of choosing MTA Trustees, and imposing stronger legislative restrictions on employee fringe benefits. In general however, these recommendations do not appear to deal with the underlying causes of the MTA deficit.

At least a portion of the deficit arises from factors beyond MTA administrative control. Long term trends such as inflation and declines in ridership associated with rising automobile use are the main reasons for the MTA deficit. These factors would have adverse effects on MTA finances even under the best management or most ideal conditions. The history of transit operations in the Boston area and elsewhere in the nation suggests that the general public must be prepared to shoulder a significant part of the cost of public transportation.

Major proposals for reducing the size of the MTA deficit involve important shifts in policy and organizational structure. These major proposals split the cost of service into operating losses and fixed charges and/or enlarge the jurisdiction of the area responsible for paying the MTA deficit by proposing that the fringe communities outside the MTA district or the state make annual financial contributions to the system. The specific costs allocated to various area government jurisdictions and the exact proportion of the allocation vary widely for each proposal.

Arguments for the assumption by the Commonwealth of part of the deficit have been advanced on the grounds that the MTA is both a state and local responsibility and that breakdown of the system would damage the economy of the state as well as the member communities. Most proposals for state subsidy have assumed that tax revenues paid into the General Fund of the Commonwealth would be used for this purpose. However, legislators who represent communities outside the district understandably have not favored an increase in state taxes to relieve the burden on communities within the MTA district and state subsidy measures have failed to secure approval.

Several arguments have been advanced for an MTA levy on fringe communities: many fringe residents park at MTA terminals and ride to their final destination via MTA; others use independent bus line connections to ride the MTA[11]; the MTA relieves traffic congestion

11. Simpson and Curtin, *Report on Survey of Passengers Using Facilities of Boston Metropolitan Transit Authority in Each of the Cities and Towns Served*, July, 1956, p. 10: "11.8% of the passengers using MTA services on a weekday began and ended their trips at points outside of the service area"; GBESC, *A Survey of Commuters on the Highland Branch*, Economic Base Report No. 7, August, 1960, p. 5. "About 40% of all commuters who board stations west of Reservoir live in municipalities outside the present MTA district."

on highways for fringe community persons that travel by auto; the MTA performs an important standby function for fringe communities when service on highways is disrupted; and further decline in service would increase fringe community traffic problems and thereby increase local taxes for street and road improvement. However, the suburban fringe communities have been unwilling to have their taxes increased to help pay for a system that many of their residents use only intermittently. From 1958 to 1960, eighteen bills were filed in the General Court advocating an assessment of part of the deficit on fringe communities.[12] None passed.

3. OPERATING CHARACTERISTICS OF THE MTA

Analysis of the MTA must include discussion of right-of-way and equipment, passenger volumes and capacity of the various forms of transit, and the basic track pattern. The main division of any public transportation system is between rail and surface transportation; therefore, much of the discussion is concerned with these two aspects of the MTA system.

A. *MTA Service Area Characteristics*

Boston is one of five major urban areas in the nation which have a rapid transit network as the core of its mass transit system. The other four are New York, Chicago, Philadelphia and Cleveland. In serving its 123 square mile area the MTA in 1961 employed 5,800 persons and operated almost 1,600 vehicles of various types over a total of about 800[13] route miles at fares ranging from ten to forty cents per passenger, according to a modified zone system. Slightly less than two hundred million passengers travelled on the MTA system in 1960 as compared to well over four hundred million in the peak years following World War II.

Table 48 compares Boston's size and coverage of its transit service district with those of Chicago and Philadelphia. Cleveland and New York are omitted from comparison because Cleveland's rapid transit system is not nearly as extensive and New York's transit system is unique and not directly comparable with that of any other city.

MTA coverage is generally similar to the two comparable major urban transit systems. All three extend beyond the central city, although none serves the whole metropolitan area. The percentage of Boston's metropolitan *population* serviced by transit is lower than in Philadelphia and Chicago, but in percentage of metropolitan *area* served by transit, Boston ranks first. Boston's population density within the transit district is almost twice that of Philadelphia but well below Chicago. It is difficult to draw any conclusions from these comparisons because boundaries of transit districts in the major urban areas are delineated on the basis of political configurations rather than on the distribution of population and economic activities.

There are extreme variations in area, population, and densities among member communities. Densities by community range from 23,100 persons per square mile (Somerville) to 2,000 persons per square mile (Milton). While the MTA district includes the highest density cities in the region, some high density areas are excluded. Eight of the 14 communities in the district have an average density of over 7,000 persons per square mile. The remaining 6 communities comprise over half the area district but contain only 28% of the population.

B. *Passenger Volumes and Characteristics*

As Figure 39 shows, passenger traffic trends for the years 1924-1960 for Boston, New York, Chicago, Philadelphia and the nation are surprisingly similar. Total passengers on public transit reached a peak in the World War II period and then declined although the rate of decline seems to have leveled off in recent years. Trend figures for the proportions of rapid transit vs. surface passengers are not available for Boston, but in the other three rapid transit cities the passenger decrease has been greater on the surface system than on the rail or rapid transit parts of the system, and it apepars to be a safe assumption that this is true for Boston.

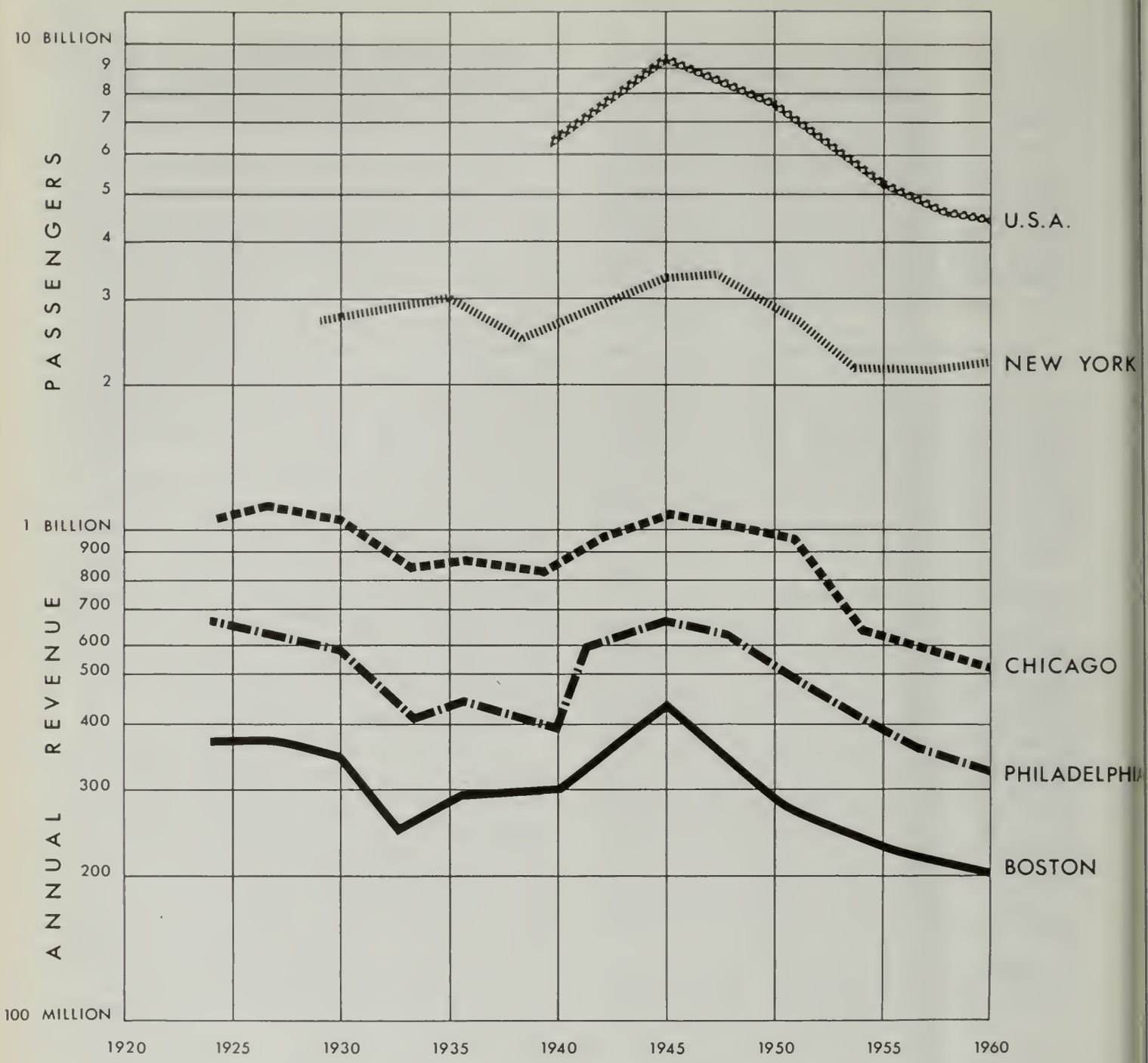
12. James H. Powers, *The Metropolitan Transit Authority and Proposed Rapid Transit Extensions to Needham* (1960), p. 65.
13. This estimate is based on 1960 data; total route mileage (including buses at that time was about 815 miles.

TABLE 48

SIZE AND COVERAGE OF TRANSIT SERVICE DISTRICTS IN SELECTED RAPID TRANSIT CITIES, 1960

	Transit Service District			Per Cent of SMSA in Transit District	
	Population (000's)	Area (square miles)	Population Density (persons per square mile)	Population %	Area %
BOSTON	1,430	123	11,700	56.0	12.8
Chicago	3,757	213	17,600	61.0	5.7
Philadelphia	2,805	414	6,300	65.0	11.6

Source: *U.S. Census of Population, 1960,* and Wilbur Smith and Associates, *Future Highways and Urban Growth.*



TRANSIT PASSENGER TRENDS, U.S. AND RAPID TRANSIT CITIES, 1924 – 1960

SOURCE: TRAFFIC QUARTERLY, JANUARY, 1962
AMERICAN TRANSIT ASSOCIATION, TRANSIT FACT BOOK, 1961

TABLE 49

ESTIMATED AVERAGE DAILY PASSENGERS ON MTA SYSTEM

	Average Daily Passengers (1959) Number	%	Route Miles (1960)	Passengers Per Mile Per Day (In 000's)
Rail Transportation	616,000	77.0	159.7	3.8
Rapid Transit	391,000	48.9	64.3	6.1
Streetcar	225,000	28.1	95.4	2.2
Surface Transportation	184,000	23.0	654.9	0.4
TOTAL	800,000	100.0	814.6	.9

Source: Gunther M. Gottfield, *Rapid Transit Systems in Six Metropolitan Areas,* (GPO, Washington, D. C., 1959), and Metropolitan Transit Authority.

After years of abnormally high transit patronage during and after World War II, the number of MTA revenue passengers declined at a rapid rate. In 1946 the MTA carried the largest number of revenue passengers in its history, but by 1960 the number of revenue passengers had declined over 50% from this peak level, an average decline of about 4% per year. As Table 49 shows, about 800,000 passengers travelled on the MTA system on an average week day in 1959, with about three-fourths carried on rail vehicles.

It is extremely difficult to determine the amount of traffic carried by the various components of the system because until 1961 there have been free transfer privileges between surface and rail lines and therefore the average daily passenger figures include an unknown number of passengers using more than one form of transportation for each trip. However, there is no doubt that rail transportation is an unusually important component of the MTA system, and in this respect it is very different from other rapid transit systems. The proportion of MTA total passengers riding rail transit is larger than that in any other rapid transit system in the nation including New York (Table 50).[14] The large proportion of rapid transit patronage both reflects and justifies Boston's relatively large rail mileage and its extensive transit equipment. Boston's unique system of taking streetcars directly into the subway is also partly responsible for this pattern. If streetcar subway routes are excluded from consideration the proportion of MTA passengers riding rapid transit is slightly reduced, but it remains higher than the other rapid transit systems except New York. Moreover, Boston ranks second to New York and well ahead of other systems in the number of annual passengers per mile of line. (Table 51)

TABLE 50

AVERAGE WEEKDAY PASSENGERS, 1959

	Total Number of Passengers	Rapid Transit Passengers	Rapid Transit % of Total
New York	6,000,000	4,500,000	75.0
Chicago	2,000,000	560,000	25.5
Philadelphia	2,000,000	570,000[1]	26.0
BOSTON	800,000	616,000[1]	77.0
Cleveland	700,000	80,000	10.0

1. Figures for Philadelphia and Boston include streetcar subway-surface routes; Boston figure may be inflated since it includes the Highland Branch route which was in operation only part of the year. Gottfield estimates that Boston had 595,000 rapid transit riders minus the Highland branch. This would lower Boston's percentage of rapid transit to 74.4%.

Source: Gunther M. Gottfield, *Rapid Transit Systems in Six Metropolitan Areas* (GPO, Washington, D. C., November, 1959).

C. *Reasons for Decline of Transit Patronage*

The main reason for the decline in the use of the public transportation system in most major cities has been the direct and indirect effects of automobile competition. Figure 40 shows the increase of automobile registrations and the corresponding decrease in use of public transportation in the MTA district between 1946 and 1960. Automobile use has affected transit patronage in two ways: substitution and decentralization.

14. Gunther M. Gottfield, *Rapid Transit Systems in Six Metropolitan Areas* (GPO, Washington, D.C., November, 1959), is the only published source that estimates MTA rail rapid transit riders. This is done for a single year only and does not negate the fact that many rapid transit riders use both rail and surface systems in the course of their journey.

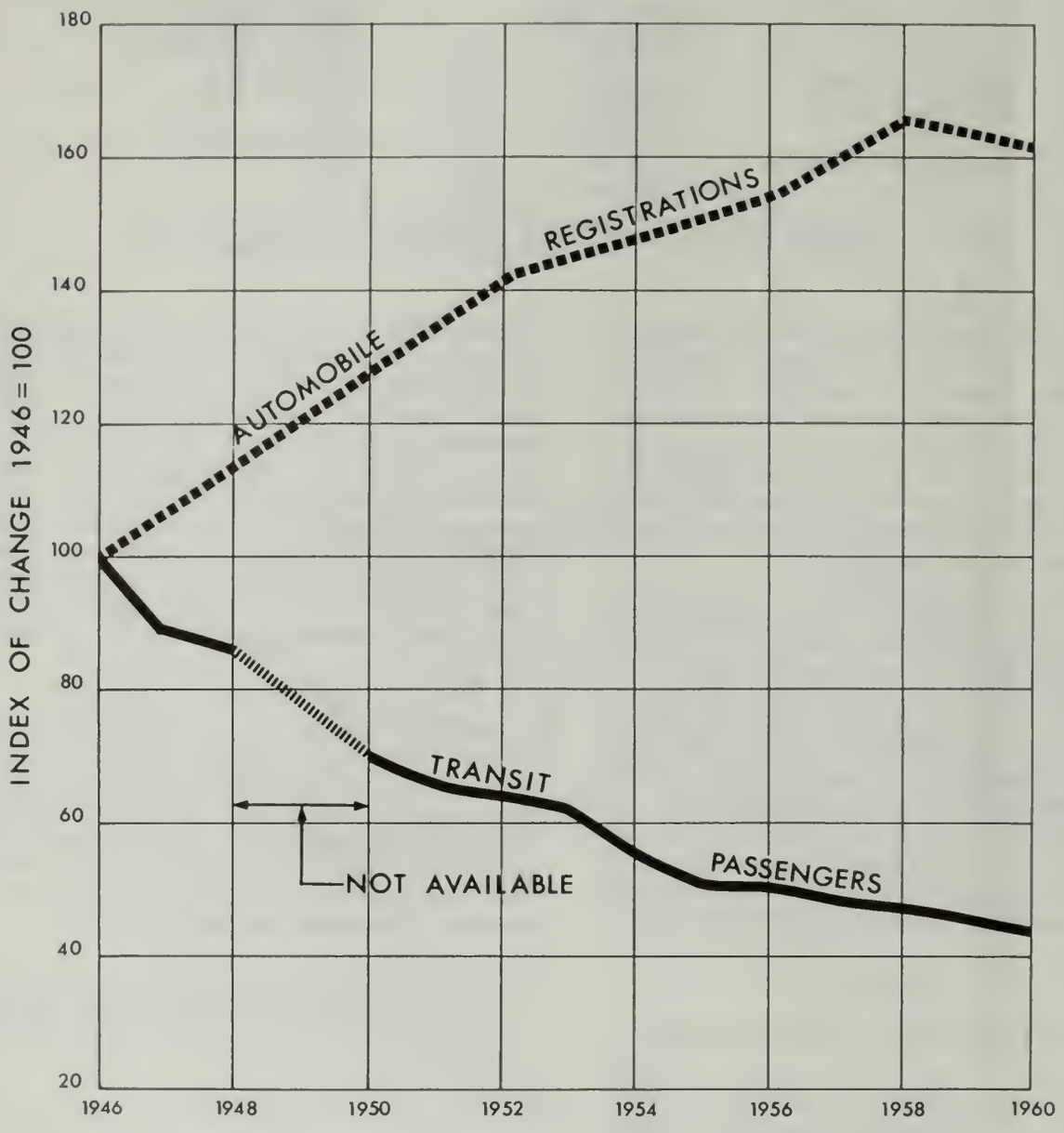
TABLE 51

RAPID TRANSIT USE, SELECTED CITIES, 1960

	Line Miles	Annual Passengers (000's)	Passengers Per Mile of Line (000's)
New York	236.7	1,328,957	5,620
Chicago	68.2	113,330	1,665
Philadelphia	32.2	73,296	2,275
BOSTON[1]	25.1	96,000	3,890
Cleveland	14.9	17,822	1,190

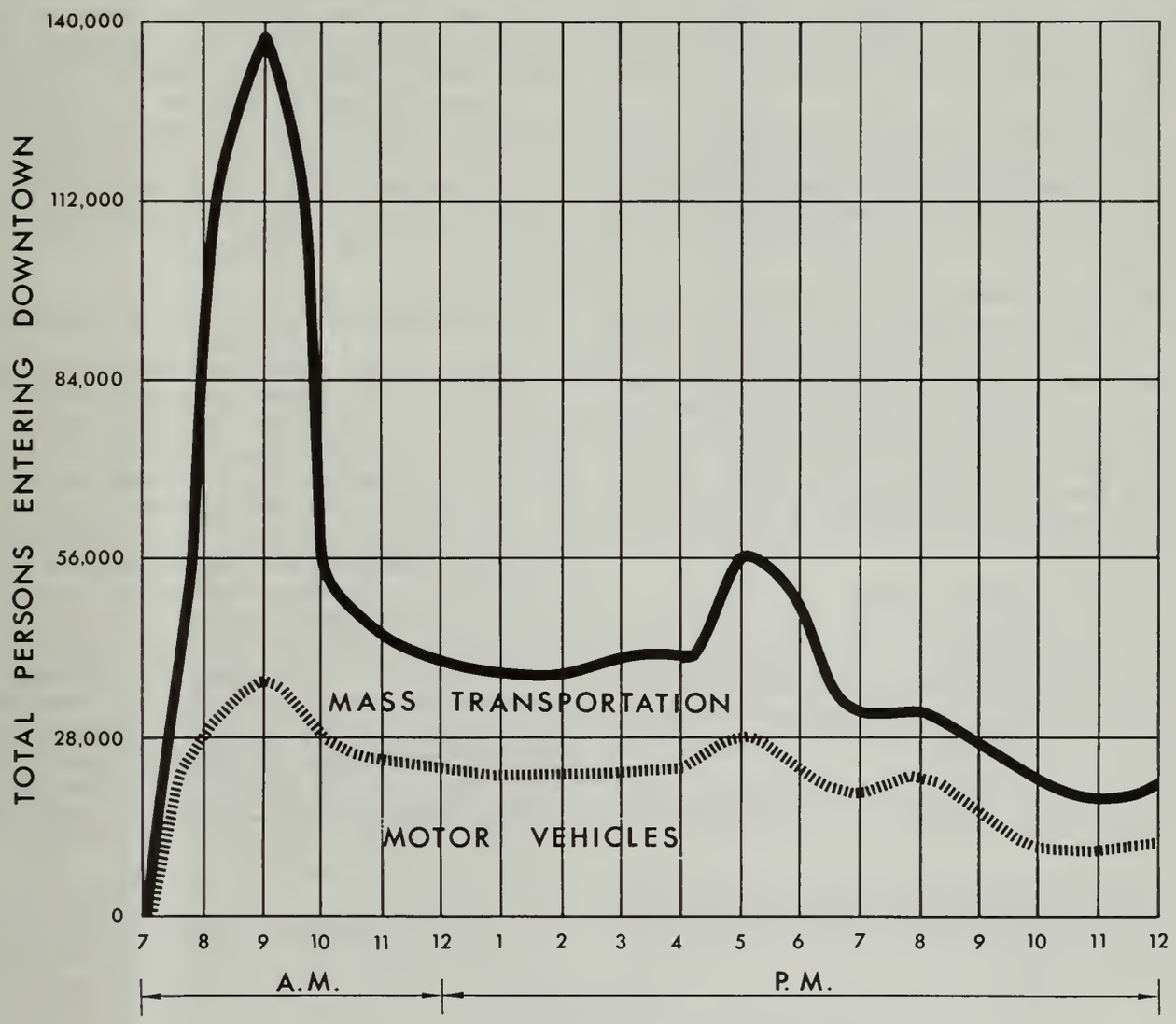
1. Excluding streetcar-subway routes.

Source: Wilbur Smith and Associates, *Future Highways and Urban Growth.* (New Haven, Connecticut, February, 1961), p. 124.



TRANSIT PASSENGERS AND AUTOMOBILES, M.T.A. DISTRICT, 1946 – 1960

SOURCE: M.T.A. ANNUAL REPORTS, MASS. DEPT. OF CORPORATIONS AND TAXATION



HOURLY DISTRIBUTION OF PERSONS ENTERING DOWNTOWN BOSTON, 1958

SOURCE: B. C. SEMINAR RESEARCH BUREAU
STUDIES OF URBAN TRANSPORTATION, 1958

The automobile has been *substituted* for transit because it is usually faster and more flexible than transit; it can provide door-to-door service. The automobile's role in assisting in the decentralization of population has also had an effect on transit patronage. The street railway helped to generate a suburban corridor growth along major routes; the automobile has stimulated development between these corridors and has also helped to move population beyond the limits of the present transit system.

A rough measure of the relative importance of the substitution and decentralization effects of the automobile on patronage of the MTA can be gained from the fact that from 1950 to 1960 transit patronage fell by 35% while MTA service area population declined by only 8%.

Many transit passengers are "captives" who must ride the public system because they are under age for driving, are too old or infirm to drive, or cannot afford to own a first or second car. On the other hand, many riders choose to use the transit system for regular trips because of its convenience or economy. In the case of a major central business district and a strong core area, such as Boston there appear to be powerful barriers which prevent complete substitution of the automobile for mass transit.

D. *Travel to Downtown Boston*

It has been estimated that over a tenth of the more than five million daily person trips in the Boston metropolitan area using all modes of transportation are made to downtown Boston.[15] The downtown area attracts a far larger number of trips than any other single area in the region.

Historically, the MTA has been a tremendous stimulus to concentration of activity in the downtown area. However, by 1959 the MTA accommodated only about 30% of the total trips to downtown while about two-thirds of the trips were made by automobile (Table 52). The bulk of the transit trips to downtown are concentrated in a few hours of the day in the morning and evening: during these peak travel hours mass transit transports more riders than travel via automobiles. Mass transit facilities carry about 70% of the people to and from downtown during the peak hours.[16] (Figure 41.)

As shown in Table 52, there was a decline of total number of persons entering downtown of about 3% over the period 1950-1959. During the decade the MTA, along with the commuter railroads and independent bus lines, carried a steadily decreasing proportion of the persons entering downtown.

E. *Rail Transportation and Surface Transportation*

Figure 42 shows that the rail system of the MTA carries 77% of the total passengers although rail transit has only 44.4% of the system's vehicles and only 18% of the total route mileage; however, the MTA system closely integrates its rail and other elements and transfers characterize a high proportion of all trips.

Total 1960 route mileage and the change since 1947 is shown on Table 53. MTA rail transportation has declined while surface transportation gained in route miles and equipment. Looking at trends by broad categories is misleading. Streetcars running on partially grade separated rail surface routes were the only category of transportation within the MTA system to show significant declines in route miles and equipment, declines which were great enough to overshadow gains in other categories of rail transportation. The gains made by surface transportation were largely due to replacement of rail surface streetcars (considered part of the rail system) by rubber-tired surface vehicles.

15. Seminar Research Bureau, Boston College, *Studies of Urban Transportation, Travel in the Boston Region* 1959-1980, Vol. 1 (January, 1960) and Volume III (April, 1961). Total trips estimated at 5,280,000; these do not include transit driver trips or non-home based mass transit trips.

16. Seminar Research Bureau, Boston College, *Transportation Facts, Public Policy for Downtown Boston* (March, 1958).

TABLE 52

TRENDS IN PERSON TRIPS TO DOWNTOWN
BY MODE OF TRAVEL, 1950 and 1959

	Person Trips			
	1950		1959	
Mode of Travel	No.	% of Total	No.	% of Total
M.T.A.	215,000	41.0	170,000[1]	29.0
Rail and Independent Bus Lines	65,000	11.0	40,000[1]	7.0
Motor Vehicles	290,000	48.0	370,000	64.0
TOTAL	600,000	100.0	580,000	100.0

1. 1959 MTA and Railroad and Bus passengers estimated by MTC planning consultant.

Sources: (1) Robert G. Davidson, *M.T.A. Rapid Transit Parking Program of the Metropolitan Transit Authority* (Boston, Mass., October, 1957.
(2) Seminar Research Bureau, Boston College, *Studies of Urban Transportation Travel in the Boston Region* 1959-1980; *An Evaluation of Transportation Needs*, Vol. III (April 1961).

TABLE 53

MTA TRENDS IN LINE AND ROUTE MILEAGE

	1947	1960	Change No.	Change %
Rapid Transit				
Line Miles	21.0	25.4	4.0	19.0
Route Miles	52.3	64.3	12.0	22.9
Grade Separated Streetcar				
Line Miles	8.8	18.2	9.4	106.0
Route Miles	21.9	40.3	18.4	84.0
Total Grade Separated Rail				
Line Miles	29.8	43.6	13.8	46.4
Route Miles	74.2	104.6	30.4	43.1
Rail Surface				
Line Miles	121.7	20.3	101.4	83.3
Route Miles	266.3	55.1	211.2	78.5
Total Rail Transportation				
Line Miles	151.5	63.9	87.6	42.0
Route Miles	340.5	159.7	180.8	50.0
Trackless Trolley				
Line Miles	34.2	84.6	50.4	148.0
Route Miles	65.6	162.2	96.6	147.0
Motor Bus				
Line Miles	203.3	274.0	70.7	35.0
Route Miles	373.9	492.8	118.9	31.9
Total Surface Transportation				
Line Miles[1]	237.5	358.6	121.1	37.0
Route Miles[2]	439.5	654.9	215.4	49.2
Total MTA				
Line Miles	389.0	422.5	33.5	8.8
Route Miles	779.8	814.6	34.8	4.5

1. Equivalent to miles of one-way street.
2. Miles comparable to miles of single track.

Source: Metropolitan Transit Authority.
Rail line miles estimated by MTC planning consultants.

The MTA uses four types of vehicles: rapid transit cars, streetcars, trackless trolleys, and motor buses. Over half of the vehicles are surface transportation vehicles. Motor buses predominate with over a third of all vehicles. Rapid transit cars, trolley cars, and trackless trolleys each made about one-fifth of the total number of vehicles.

As compared to other urban areas with major transit systems, Boston has about the same proportion of rail and surface vehicles as Philadelphia but relies to a far greater extent on rail vehicles than Chicago and Cleveland.

a. *Rail Transportation*

Rail transportation in Boston, as elsewhere in the country, consists of trains operating on fixed tracks. The MTA has approximately 64 line miles and 160 route miles of rail line (Table 53). Line miles represent traveling distance whereas route miles are the actual track mileage including sidings and yards.

Rail transit provides high speeds and dependable low cost scheduled services for large volumes of passengers. Capital costs for right-of-way acquisition and equipment are high, but equipment and facilities are extremely durable and depreciate slowly, which tends to reduce overall replacement costs.

As well as the above-listed advantages, rail transit presents certain disadvantages. High initial construction or acquisition costs for rail transit lines impose a burden of heavy fixed charges. Because rail transit vehicles require a special right-of-way, maintenance and repair tends to be costly. Also, because of the complex nature of the specialized rail vehicle, and because rail cars are not sufficiently standardized to be mass produced, the initial purchase price for equipment is relatively high. While the operating costs of rail transit are comparatively low for personnel actually engaged in transit service, the specialized nature of rail transportation tends to increase general costs for fare collection and other purposes. The main disadvantage of rail transit, how-

ever, is its inflexibility. Route changes are practically impossible. For this reason any construction or extension of a rapid transit route should be based on a prudent assessment of future needs.

There are three types of MTA rail transit. Rapid transit refers to rail transit that has a grade separated right-of-way permitting speedy, scheduled service without interference from other modes of transportation.

Grade separated rail surface routes are characterized by low construction costs but high land acquisition costs. Both land acquisition and construction costs can be reduced considerably if an existing railroad right-of-way or the median strip of a limited access highway is available. The extensions of Boston's rapid transit system during the last few decades have been built on the surface over abandoned railway lines.

Separate transit rights-of-way built below or above public streets avoid high land acquisition costs in areas of concentrated development. Construction costs increase greatly, however, because of the complexity of construction. Subway tunnels are by far the most expensive right-of-way to build. For this reason almost three-quarters of Boston's grade separated rail transit mileage is in elevated or surface routes.

Boston is unique among major American cities in having two adaptations of rapid transit, the so-called "authentic" rapid transit and streetcar rapid transit.

i. *"Authentic" Rapid Transit*

Rail transit that is grade separated for the entire length of its route is considered by some authorities as the only authentic rapid transit. At no point does traffic from other modes of transportation interfere, making it the most rapid and dependable rail service. In Boston this type of rapid transit right-of-way is found underground in subway tunnels, on elevated platforms over city streets, or on the surface as completely grade separated lines. Because authentic rapid transit uses large, heavy cars capable of being linked into long trains, it provides a relatively comfortable ride and offers large passenger capacity.

The MTA compares favorably with other transit systems in the age of its rail vehicles; only 19% of the MTA's vehicles were acquired prior to 1920, a lower percentage than in New York or Philadelphia.[17] The acquisition of 90 new rapid transit cars beginning in the fall of 1962 for the Cambridge-Dorchester line will help to make Boston's rapid transit equipment one of the most modern in the nation.

ii. *Streetcar Rapid Transit*

Boston depends heavily on streetcars running on grade separated right-of-way in subways, elevated platforms, or on the surface. Cleveland and Philadelphia also provide this type of intermediate capacity service but it is not nearly as extensive or as operationally important as in Boston's system.

Streetcar rapid transit offers comfort, speed, and capacity which are greatly superior to rail surface routes with no grade separation. The system also meets one of the requirements of rapid transit by relieving surface street congestion. Its lighter, less complex, and more standardized equipment than authentic rapid transit results in lower capital costs for modernization and extension.

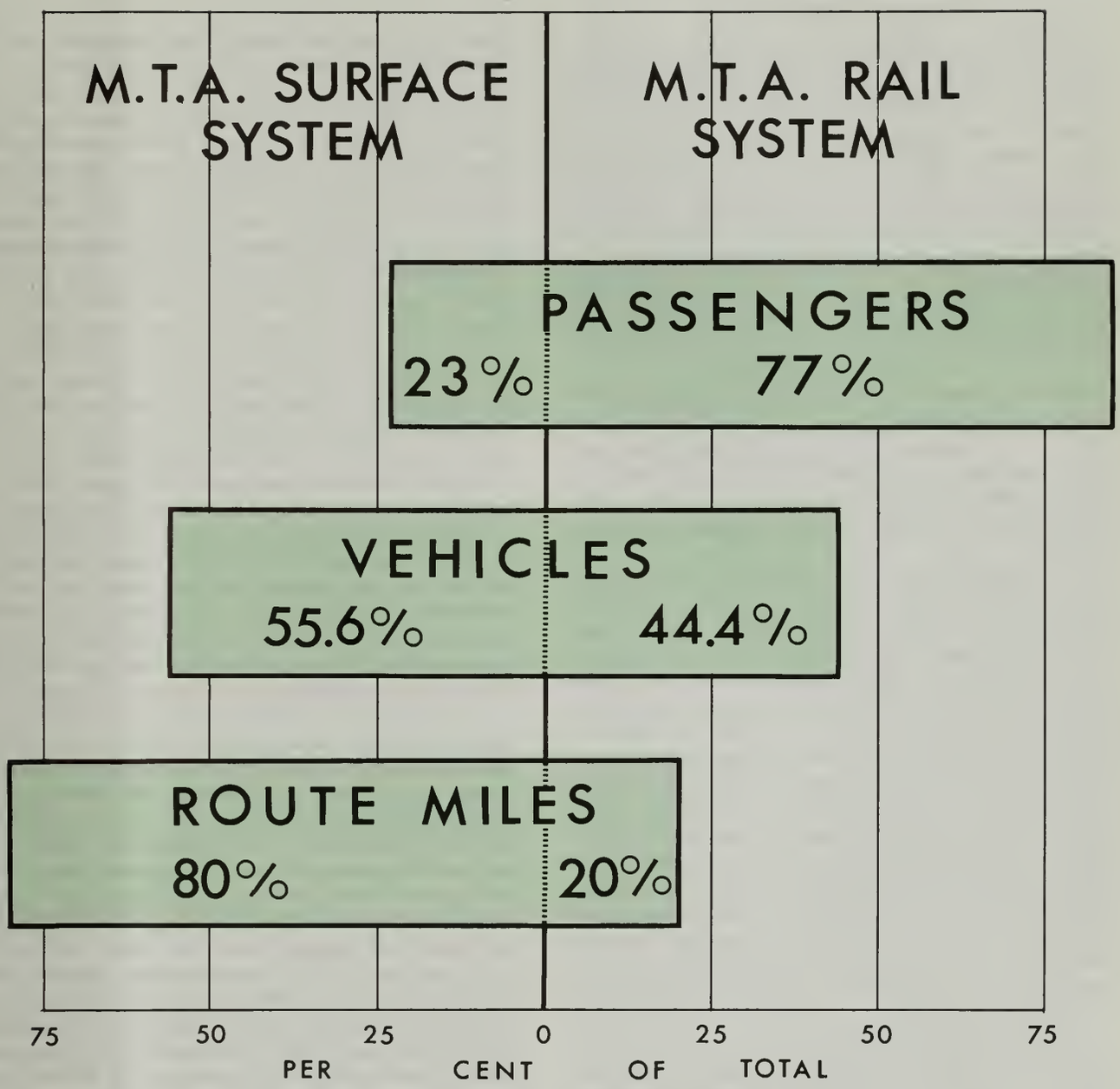
Streetcar rapid transit is especially advantageous for moderate payloads but the heavy volumes on portions of the Boston system reduce the efficiency of this type of service. Further (1) The comfort, speed, and capacity of streetcar rapid transit is not on a par with that of authentic rapid transit. (2) Streetcars have lower speeds than transit and the size of the train in the Boston system is limited to three cars. (3) The physical integration of this system with partially grade separated rail surface lines creates special problems. (4) Automobile traffic congestion on the surface makes scheduled, frequent intervals between cars on rapid transit portions of the line difficult, reducing the speed and dependability of service. (5) The large number of branch subway and surface routes that feed into Boston's main streetcar subway act to reduce headway, speed, capacity and dependability of the system. (6) Full savings in operating personnel cannot be achieved because an operator is required for each car.

However, because of the lower capital cost of expansion and despite the many operational disadvantages of the system, route mileage of streetcar rapid transit was increased as a result of the 9.4 mile Highland Branch extension.

Apart from the underground or grade separated streetcars, the MTA has about 55 route miles of partially grade separated streetcar rail surface routes. Because of their direct and convenient connection with the streetcar subway, these lines probably carry a higher number of passengers than streetcars lines with no such connections. The surface streetcars operate on city streets in median strips that separate opposing streams of traffic, although the degree of separation may vary on a portion of a few lines. There is actually only partial separation from traffic since autos and streetcars interfere with each others' movements at numerous intersections.

Rail surface streetcar routes have all the disadvantages of other forms of rail transit with very few of the advantages. Saddled with the same high construction and maintenance costs as rapid transit, these lines have practically none of rapid transit's speed advantages. Restricted to fixed rails, streetcars cannot easily change their routes and are unable to maneuver in the general stream of automobile traffic. Where the median strip is not grade separated, the embarking and discharging of passengers is unsafe and causes excessive delay for both automobile and transit.

17. American Municipal Association, *The Collapse of Commuter Service; Survey of Mass Transportation in Five Selected Cities* (Washington, D.C., 1959).



M.T.A. RAIL AND SURFACE TRANSPORTATION
PASSENGERS, VEHICLES AND ROUTE MILES

SOURCE: GOTTFIELD, RAPID TRANSIT SYSTEMS IN SIX METROPOLITAN AREAS, 1959
M.T.A. ANNUAL REPORTS

b. *Surface Transportation*

There are two types of non-rail surface vehicles in use by the MTA: motor buses and trackless trolley coaches. While surface route mileage in the nation increased by only about 19% in the period from 1945 to 1960,[18] Boston's mileage increased almost 50% between 1947 and 1960. Most of these surface routes represent a replacement of rail lines by surface vehicles. Bus route mileage showed greater absolute gains than trolley coach mileage. Although the trackless trolley category recorded significant gains in vehicles from 1947 to 1960, the peak number of vehicles was actually reached in the mid-1950's. The number of motor buses has fluctuated around the same level since 1947.

Because surface vehicles use public roads, all of their fixed costs are directly related to providing transportation service. Surface vehicles can operate almost anywhere resulting in great route flexibility and permitting more complete coverage than fixed rail systems. Timetables and routing of buses can be changed according to demand.

On the debit side, surface vehicles generally provide lower speed, less dependable service, and a less comfortable ride than rail transportation. They cannot carry large volumes of passengers, because of the size of the vehicles and their inability to link into trains. Since they share the road with automobile traffic, operating speeds are reduced. Delays caused by traffic congestion and traffic control devices may account for as much as 18% of surface vehicle running time.[19] Delays occur mainly in the inner areas of a city; in low density suburbs surface vehicles can use less congested collector streets and relatively high speeds can be achieved over longer routes. On the debit side, surface vehicles have helped contribute to high MTA operating costs in recent years because an operator is required for every vehicle load of passengers. Another cost factor is the short life of the equipment, resulting in frequent need for replacement costs.

Trackless trolleys or trolley coaches are buses that operate by drawing electric power from overhead electric lines. They serve as feeders in relatively dense areas where the demand for frequent service is great enough to justify the economies of electric traction. The trackless trolley is more flexible than rail transit but much less flexible than the motor bus. The vehicles are undependable and slow in severe Boston winters. Their need for overhead power distribution facilities along right-of-way increases the cost of maintenance and restricts freedom of movement, which also makes the adjustment of the route patterns for better service difficult. The average power costs for trolley coaches is higher than the fuel cost for diesel motor buses, although maintenance costs for trolley coaches themselves are lower. The total power-maintenance costs are generally lower for trackless trolleys, but this saving is offset by the higher initial acquisition cost for trolley coaches and the high installation and maintenance costs for the overhead power facilities. Personnel operating expenses are the same for both types of surface vehicles. Trackless trolleys have advantages on routes with high stable demand, but their inflexibility is probably responsible for their recent decline in numbers. Popular after the war throughout the country, trackless trolleys began to be replaced by the early 1950's in most cities. However, Boston has not kept pace with other systems and retains more trolley route mileage than most rapid transit cities. In fact, the MTA's route mileage of trackless trolleys has more than doubled since 1947, reaching a peak in the late 1950's Only during the last few years has a reduction occurred. The MTA now plans to replace all of its trackless trolleys with diesel buses.

Buses account for the largest amount of route miles and equipment in the MTA system. Buses have generally low capital costs and are the most flexible of all public transportation vehicles. Sharing the public right-of-way with other motor vehicles, they have no costs associated with fixed plant. Since buses are standardized and mass produced, the purchase price of equipment is low. Although bus operating costs are higher than rail transit because an operator is required for every payload of passengers, there are little or no indirect costs for station personnel. Traveling over a variety of rights-of-way such as surface streets, freeway lanes, reserved lanes, and special bus roadways, buses can provide high speed service and at the same time act as their own feeders. Buses operate at higher speeds than trolley coaches because of their maneuverability in the general traffic stream, but generally offer lower speed, comfort and dependability than rail transit. Even on specialized rights-of-way, local stops, traffic lights, and peak hour traffic congestion cause delay for buses.

The MTA's route mileage of buses has increased over one-third since 1947, but the proportion of buses is still well below most rapid transit cities. The number of MTA buses has fluctuated at around the 600 level since 1947, a trend that runs counter to the increasing number of buses being used throughout the nation. MTA bus capacity has not been reduced, however, since its large new 50-seat buses can carry a passenger load that formerly required two small buses.

MTA buses now operate almost entirely on urban arterials. There are no special bus roadways now in existence or planned in the Boston area, partly because a special bus roadway poses some of the same space-using problems and high construction costs as does a rail rapid transit system. Boston already has an extensive grade separated right-of-way system. Another attempt to speed bus service is the reserved bus lane, particularly in downtown streets. Reserved bus lanes on downtown streets do not exist and are not planned for Boston because of Boston's heavy investment in rail rapid transit

18. American Transit Association, *Transit Fact Book*, 1961.
19. Donald S. Berry, et. al., *Technology of Urban Transportation*, Transportation Center, Northwestern University for the Automobile Manufacturers Association (unpublished draft) p. 13.

and because its narrow and circuitous downtown streets are not wide enough for this purpose.

One advantage of buses which has been little exploited is the possibility of high speed service on either specialized rights-of-way or on expressways. None of Boston's expressways have yet been used for express bus service, perhaps because only two of the many limited access radial highways are completed all the way to the center of Boston, and most expressway improvements have been outside the MTA service area. The completion of the Inner Belt expressway will provide a highway facility that may prove highly attractive for bus operations.

F. *Rapid Transit Track Patterns*

There are three basic types of transit patterns: The grid pattern consists of parallel sets of lines intersecting at regular intervals. This arrangement offers complete coverage serving an even distribution of population, but because it requires a large amount of track, the grid is an expensive system. In the United States, only portions of the New York City system resemble this pattern.

The ring pattern consists of a series of circular, concentric lines spaced at intervals from the center of the city. With the radial pattern of development of most cities ring routes would run through open territory, except in areas close to the city's central district. Some New York City belt lines and Chicago's loop resemble this pattern.

The star pattern consists of radial rapid transit lines running from the center of the city in a number of directions. The best access is at the center where lines converge. The star patterns best serves a city with a centralized, concentrated core and a gradual gradient of decreasing densities as distance increases from the center. This arrangement most conforms to traditional forms of city development and all rapid transit cities in the nation conform to the star, except for the limited exceptions noted above.

The MTA, following a radial pattern, has as many transit lines fanning out from the center as Chicago and Philadelphia. However, the MTA's authentic radial rapid transit lines average only five miles from the center of Boston, and for this reason MTA's radius of coverage is less complete than other transit districts. When streetcar rapid transit is included in the comparison, Boston's radial coverage exceeds that of Philadelphia, largely due to the 9.4 mile Highland Branch extension.

Four principal rapid transit lines form the structural core of the MTA system, as shown in Figure 43. Two parallel lines, the Washington Street and Tremont Street subways, run in a north-houth direction through the central business district. Three lines, Cambridge-Dorchester, East Boston and Boylston Street subway, cross the business district in an east-west direction. In addition, from the Boylston Street subway, the Huntington Avenue branch makes rail-surface connections to Roxbury and Jamaica Plain. At Kenmore Square in the Back Bay two surface branches emerge to serve the communities of Brookline, Allston, Brighton, Watertown and Newton; also from Kenmore Square, the grade separated Highland Branch serves Brookline and Newton.

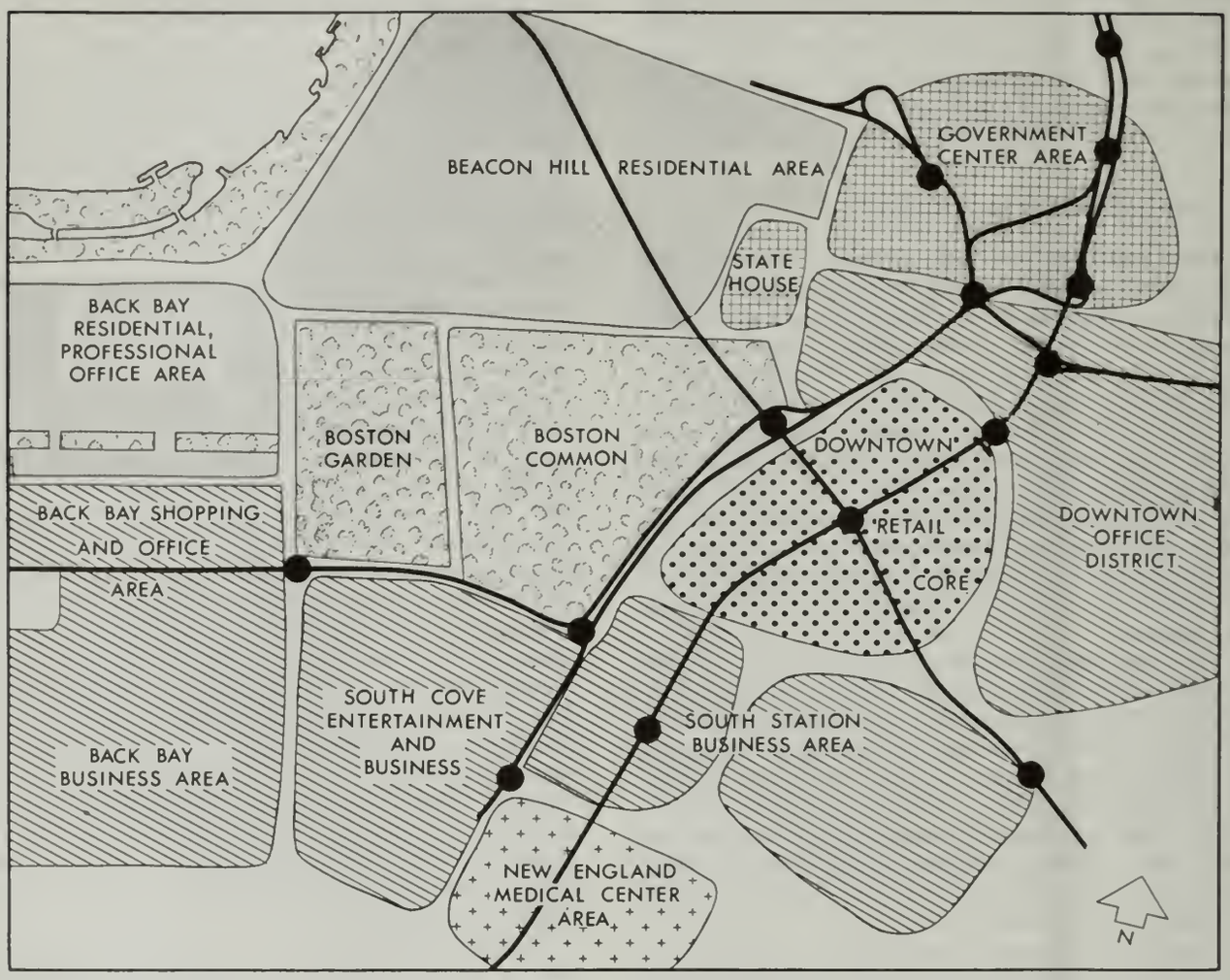
G. *Central Business District Stations*

The MTA rapid transit system provides excellent downtown coverage with most of the central business district and secondary centers located within walking distance of rapid transit stations. The only important areas that do not receive adequate direct service are the Park Square-Stuart Street theater and office district and the Charles River Park (formerly the West End) and Beacon Hill residential areas.

The variety of routing patterns at Downtown Boston terminals generally has negative effects on the efficiency and capacity of Boston's rapid transit system. Through-routing on the Forest Hills-Everett and Cambridge-Dorchester lines efficiently handles heavy traffic by quickly discharging inbound passengers and picking up outbound passengers at downtown terminals and continuing over the same line to the opposite side of the city. The continuous flow of vehicles enhances speed and efficiency. But turn-around loop terminals beyond Bowdoin station on the East Boston line, at Park Street station and at North Station are not as efficient. This type of terminal routing is space and time consuming, reducing the efficiency of the lines in handling large numbers of passengers. The East Boston turn around loop located near Bowdoin station is particularly unproductive. A combination of through-routing, turn-around loop and many branch lines at the Boylston-Tremont Street subway's Park Street station tends to concentrate large volumes of people at this central point. People accumulate faster than they can be carried away, limiting the efficiency and capacity of the station in handling passengers.

Boston, unlike Chicago, has no distribution loop connecting various stations and encircling the downtown area to continue the journey to outlying areas.

All of the MTA's radial routes do not converge at one point in the central business district. Convergence would be undesirable because of the strain it would impose on the system in handling large volumes of passengers at a single point. The near convergence which exists in Boston is considered more desirable. In the Boston system this is achieved in two ways. First, closely spaced stations connect to one another via short underground passages. Second, the east-west and north-south routes intersect at four key stations that form a small square roughly defining the core of Boston's retail-financial district. Access in all directions is provided at intersections by direct physical connections and free transfer privileges. Ativities located at or near these central stations are more accessible as compared to those located along ordinary way stations. All of these



DOWNTOWN BOSTON RAPID TRANSIT SYSTEM

SOURCE: REPORT, PROPOSED SUBWAY FACILITIES, THE PRUDENTIAL AND GOVERNMENT PROJECTS, M.T.A., MARCH 1959.

stations, except Scollay and Boylston, have the highest one way passenger volumes in the transit system. The Washington-Summer-Winter station which most closely approximates the center of the rapid transit system, has consistently maintained the system's highest passenger volumes.

H. *Major Terminal Stations*

Six stations, by virtue of their position at the ends of rapid transit lines, are important connecting points for MTA and independent surface lines. These are shown on Figure 44. With the growth of population in peripheral areas outside the boundaries of the MTA, these terminal stations have become strategic connections that provide rapid transit access to outlying areas via surface routes. Other end-of-line stations have not been developed as true terminals. Bowdoin Station, at one end of the East Boston line, is located in an area peripheral to downtown. Kenmore and Symphony stations mark the end of the rapid transit portion of subway-surface routes, but the cars continue directly by incline to the surface, traveling on the surface to end-of-line terminals that are not rapid transit stations.

Three characteristics distinguish rapid transit terminal stations and serve as a basis upon which to evaluate their effectiveness. First, relatively high one way traffic volumes indicate their importance as gateways to the rapid transit system. Second, a large number of connecting independent and MTA surface lines indicate the relative importance of their strategic location as a focus for outlying areas. Lastly, the number of parking spaces is an indication of how terminal stations accommodate patrons from outlying areas. Characteristics of the six MTA rapid transit terminal stations are found in Table 54.

Harvard Square station, western terminus of the Cambridge-Dorchester line, with the fourth largest one way traffic volume in the system and the largest number of connecting surface lines, is the most important rapid transit terminal station in the MTA system. It is closely followed in this respect by Ashmont and Forest Hills stations. Harvard Square achieves its great importance, despite its relatively short distance from the center of Boston, by its location in relation to dense residential and institutional areas. However, the large number of surface lines connecting with the station in the middle of an important intersection and the lack of parking space limits the effectiveness and efficiency of the terminal.

Ashmont and Forest Hills, on the other hand, achieve importance as terminal stations because their relatively great distance from central Boston aids them in tapping the market in outlying areas. Connecting at Ashmont station is a high speed trolley line that travels on an abandoned railroad right-of-way to service parts of Mattapan and Milton. Four of the seven stations on the Mattapan line have parking areas.

Table 54 shows that Everett, Lechmere, and Wonderland stations are less important as terminals. The Everett terminal does not extend rapid transit very far north of Boston. It is situated in the heart of an area devoted to industry and transportation activities, but it does not directly serve the densest residential section of Everett. Lechmere, the northern terminus for the Tremont Street subway, is not far from the center of Boston. The Cambridge-Dorchester lines crosses almost the whole length of Cambridge and serves as a more convenient connector for outlying areas to the west and northwest. The Everett terminal offers more convenient connections for outlying areas directly north of Boston. The location of Lechmere between two longer radial transit routes diminishes its importance as a connector to outlying areas and as a service point for areas inside the MTA district. This situation, together with the blighting effect of the elevated portion of the Lechmere line in the vicinity of North Station, has led to suggestions for elimination of the North Station-Lechmere portion of the line.

The insignificance of Wonderland terminal in Revere is not related to its distance from the center of Boston, but rather to its location in relation to the travel corridor in its immediate vicinity. It is as far from the center of Boston as other more important terminals, but its

TABLE 54

RAPID TRANSIT TERMINAL STATIONS

Station	Rank Order in Total System	1960 One-Way Passengers	No. Parking Spaces	No. of Connecting Surface Lines		
				MTA	Other	Total
Harvard	4	38,100		13	1	14
Ashmont	5	22,500		8	2	10
Forest Hills	7	18,900	126	8	4	12
Everett	11	15,200	480	7	1	8
Lechmere	14	12,700	385	4	—	4
Wonderland	35	3,600	480	2	2	4

Source: MTA passenger count December 7, 1960 and System Map: *Report of the Joint Special Legislative Committee on Transportation.* Commonwealth of Massachusetts, House No. 3400, January, 1962.

TABLE 55

INTERMEDIATE TRANSFER STATIONS

Station	Rank Order in Total System	1960 One-Way Passengers	Number of Connecting Surface Lines MTA	Other	Total
Dudley	2	42,100	12	—	12
Sullivan Square	6	19,300	12	2	14
Massachusetts	9	17,200	3	—	3
Fields Corner	12	14,900	5	2	7
Central	15	11,800	5	—	5
Egleston	16	11,300	4	—	4

Souree: MTA passenger eount, Deeember 7, 1960 and System map.

immediate service area is sharply limited by the ocean to the east and the sparsely populated Lynn-Saugus marshes directly to the north. The Wonderland Dog Track, like the linear residential and amusement area to the east, is only a seasonal traffic generator.

I. *Rail Surface Terminals*

Except for the Riverside terminal of the Highland Branch extension and the Mattapan high speed trolley line, the end-of-line terminal stations of rail surface routes are not rapid transit terminals. These terminals, however, are important indirect connectors to the rapid transit system. With its large parking area and accessibility from Route 128, the Riverside terminal taps a large number of outlying suburban communities. About 40% of all commuters who board at stations west of Reservoir live in municipalities outside of the MTA district. Mattapan is the end-of-line station for a short, high speed streetcar surface line that connects with Ashmont terminal.

There are other end-of-line surface stations. The Commonwealth Avenue surface line ends at the border of Newton near Boston College, a branch of the line to Watertown ends near Watertown Square and Newton Corner, the Beacon Street surface line terminates at Cleveland Circle where connections can be made to the Highland Branch, and the Huntington Avenue line ends at Arborway near Forest Hills.

J. *Intermediate Transfer Stations*

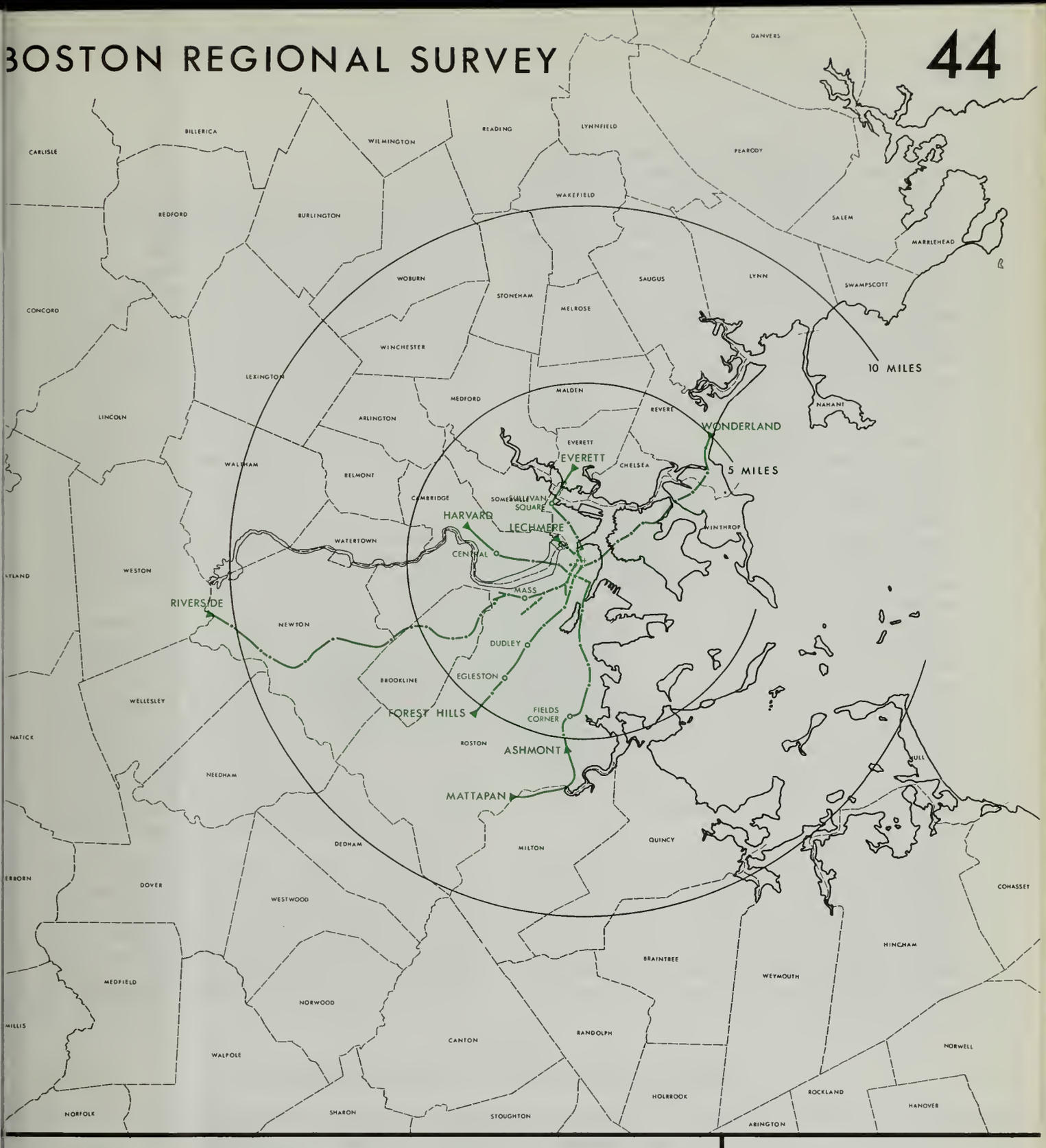
Several way stations along rapid transit lines are key transfer points for surface routes bringing passengers from more remote sections of travel corridors. The more important intermediate transfer stations have two characteristics in common: (1) they have relatively large one-way passenger volumes compared to other terminals and way stations in the system, and (2) they are served by a large number of connecting surface lines. The six most important MTA intermediate transfer stations, as distinguished by these characteristics, are listed in Table 55 in the order of magnitude of 1960 one-way traffic volumes. Dudley station, located at the midpoint of the southern leg of the Forest Hills-Everett line, is the most important intermediate transfer station in the system, followed by Sullivan, Massachusetts, Fields Corner, Central and Egleston stations.

These key stations are generally located at the intersection of major urban arterials in the local street system. Located at approximately the same distance from the center of Boston, they are concentrated on the most heavily traveled rail rapid transit lines at the midpoint of longer radial legs and near the terminals of shorter radial legs. Some of the intermediate transfer stations are located in older sub-regional shopping centers or "junior downtowns", which were established before the automobile era. When retail and business establishments decentralized from the center of the city to serve outlying areas, they expanded their trade area beyond the scope of the local community by locating at the key intersections of public transportation lines. Decentralization occurred at relatively short distances from the center of the city because of the restricted radius of travel of public transportation in pre-automobile days.

Dudley Station, with the second largest traffic volume of any station in the system is at the center of an active business district serving all of lower Roxbury. Egleston station, further south on the same line, is not located at a major business center and is a less important intermediate transfer station. The concentration of transfer points on this southern leg of the Forest Hills-Everett line is explained by the relatively long length of the radial and the dense residential areas in the adjacent travel corridor not served by any other rapid transit route. The northern leg of the Forest Hills-Everett line is relatively short. Sullivan Square station is not only an intermediate transfer point, but from its location near the end of the line, appears to assume a terminal function as well. Located closer to residential areas, it appears in some ways to be a more strategic connection for outlying areas than the Everett terminal on the same line. Like the Harvard Square terminal, Sullivan is served by a large number of connecting surface lines.

Despite the length of the southeastern leg of the Cambridge-Dorchester line, Fields Corner station located

BOSTON REGIONAL SURVEY



M.T.A. RAPID TRANSIT SYSTEM

- END OF LINE TERMINALS
- DOWNTOWN TERMINALS
- TRANSFER STATIONS
- LINE STATIONS

SOURCE: M.T.A. SYSTEM ROUTE MAP

NORTH

1 SQUARE MILES

0 1 2 3 4 5
MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION
BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

near Ashmont terminal is the only transfer point on that section of the line. This station assumes both transfer and terminal functions. The paucity of transfer stations on the radial leg, (as compared to the Forest Hills Line) is probably due to the proximity of the middle portion of the line to the Atlantic Ocean which restricts the size of the travel corridor. The short western leg of the Cambridge-Dorchester line has one intermediate transfer point — Central Square station — located in the heart of a subregional shopping center. MIT has offered to share the cost of building a new rapid transit station beyond Central Square to serve its Technology Square development.

The location of the East Boston line near the ocean is responsible for the lack of an important transfer point on the line. Massachusetts Station, the only transfer point on the streetcar subway, peripherally serves a mixed business, professional, residential, and institutional area. With the construction of the Prudential Center, volume on this station is likely to increase.

Intermediate transfer stations are located in the heart of areas that have declined in importance because of the decentralization of population and business to the suburbs. These stations accommodate the types of short transit trips that have most likely been replaced by automobile travel. Moreover, they are located at the intersections of major urban roads that have experienced a tremendous increase in traffic congestion which reduces their effectiveness and efficiency. Many of the stations are physically obsolete and inconvenient, further discouraging passenger patronage. For these reasons, intermediate transfer stations have probably felt a strong impact from declining transit patronage.

All of the intermediate transfer stations provide both circumferential and radial connections. An imaginary line drawn to connect intermediate transfer stations on adjacent radials produces an arc circumscribing central Boston in the same approximate location as the proposed Inner Belt expressway. These stations, if properly connected, could probably serve many of the same travel desires that will be accommodated by the Inner Belt.

K. *Capacity*

Capacity is a term used to designate the maximum number of people that can be carried past a point on a specified route within a given period (usually an hour). Capacity depends on the type of transit vehicle used and the frequency of operation. Frequency of operations, in turn, depends on speed of operation and speed is influenced by right-of-way design, station loading capacity and the number, spacing, and duration of station stops. The most successful and efficient operation of a public transportation system depends on a proper matching of passenger demand with capacity.

The ability of rail vehicles to be linked together to form trains gives them the highest capacity of all modes of transportation. They can carry a maximum of 40,000 persons per hour, although this level is rarely achieved. At the other end of the scale, surface vehicles can achieve peak hour passenger volumes ranging between 4,000 and 7,000 passengers per hour. The streetcar, particularly when operated on a separated right-of-way in three car trains, may achieve a capacity between 10,000 and 15,000 persons per hour.

The three regular rapid transit lines in Boston present no capacity problem. These routes are grade separated over their entire length, permitting frequent scheduled headways during peak hours. But there are capacity problems with the streetcar subway that continues on the surface as a partially grade separated operation. Traffic congestion interfering with street operation on the surface results in irregular spacing and frequent pile up of streetcar units in the subway. The six branch routes feeding into the Boylston Street subway present problems in maintaining speed and scheduled headways.

The spacing of stations also has an effect on speed and therefore on capacity. Transit vehicles take some time to reach full acceleration once they have stopped. Fewer, wider-spaced stations result in less delay for accelerating and decelerating and results in lower overall running time. Some rapid transit systems, such as in Cleveland, have been able to operate at higher speeds

TABLE 56

DAILY PEAK HOUR RAPID TRANSIT PASSENGERS

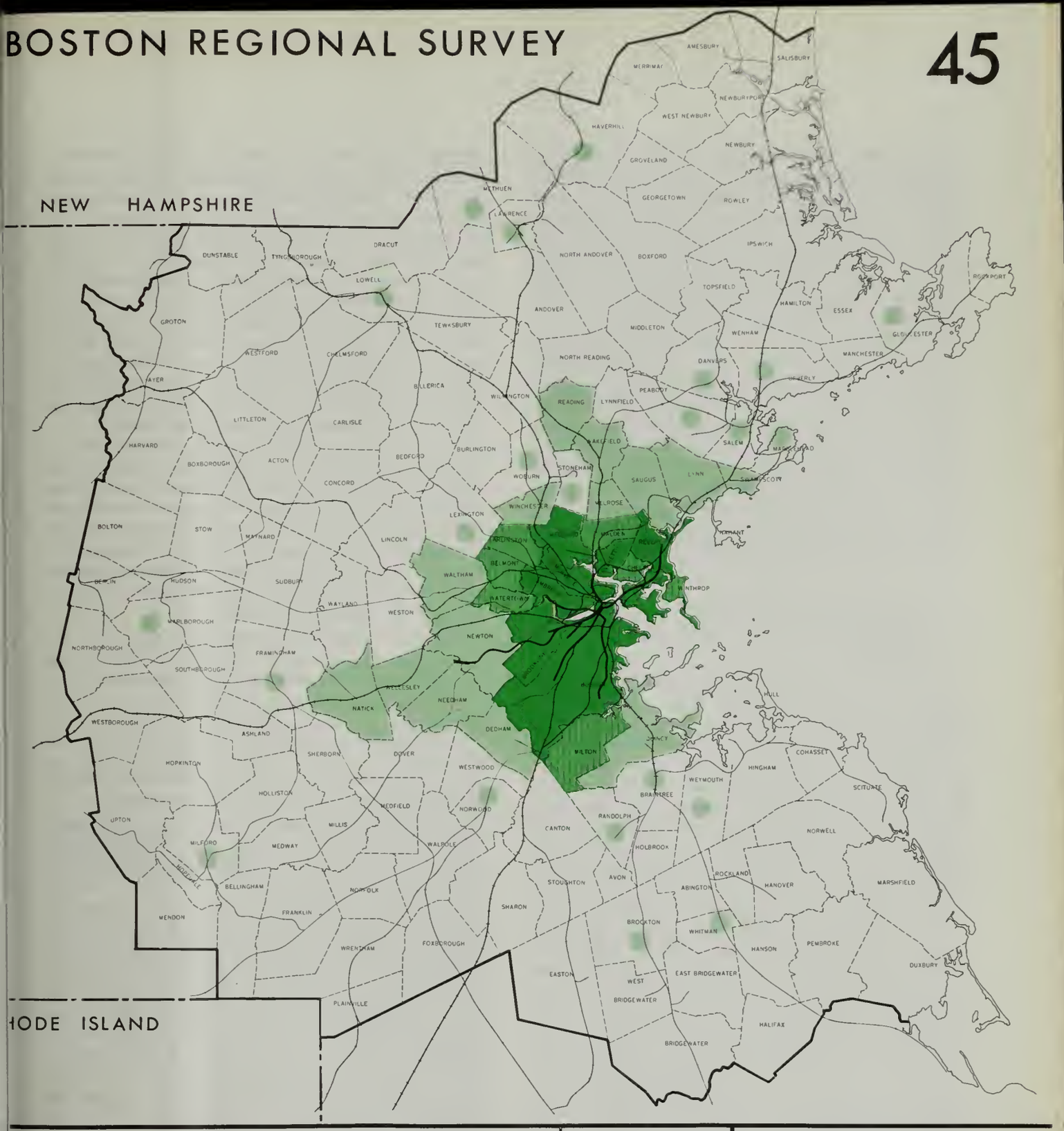
	All Day No. Passengers	Persons Per Track Per Hour	Peak Hour Volume	Peak Hour as a Percent of Daily Traffic
New York	4,490,000	—	672,000	15.0[1]
Chicago	559,000	28,000	177,000	19.2
Philadelphia	570,000	20,000	94,000	16.5
BOSTON	616,000	18,000	106,000	17.2
Cleveland	80,000	10,000	18,000	22.5

1. Represents per cent of daily total trips in peak hour.

Source: Wilbur Smith and Associates, *Future Highways and Urban Growth,* (New Haven, Conn., February, 1961), pp. 125-126.

BOSTON REGIONAL SURVEY

45



MASS TRANSIT WORK TRIPS, 1959

WORKERS USING PUBLIC TRANSPORTATION

- UNDER 10 %
- 10 – 19 %
- 20 – 29 %
- 30 – 39 %
- NO FIGURES AVAILABLE FOR THIS AREA

SOURCE: U. S. CENSUS, 1960

PARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 2560 ACRES

SQUARE MILES

0 5 10 MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED

where stations are spaced farther apart. Chicago has instituted a skip-stop system on major lines where the frequency of service is somewhat comparable to the system of limited stops used on the Harvard-Ashmont line. The New York City transit has separate express tracks on which stops are made only at stations spaced one to two miles apart. Speed is limited on the MTA system because regular rapid transit stations are a little better than half a mile apart on most lines.

Table 56 gives a daily peak hour rapid transit use in the major rapid transit cities, but it should be realized that these are not capacity figures but actual passengers handled at peak hours. Most rapid transit plans seem to provide only for the two extreme capacities, the full rapid transit capacity and the low bus capacity. An intermediate transit facility with intermediate capacity could prove highly useful. In fact, Boston's new Highland Branch, has been singled out together with similar examples in San Francisco, Europe, and South America, as pointing the way to a partial solution of some major mass transportation problems.[20]

4. PLANS AND PROPOSALS FOR PHYSICAL IMPROVEMENTS TO THE TRANSIT SYSTEM

There have been many proposals for changing and expanding the public transportation system of the Boston Metropolitan Region, based on the assumption that a large untapped market for mass transportation exists beyond the present boundaries of the MTA district. Most of the proposals are based on the electrification of existing railroad rights-of-way and are extensions of the existing rapid transit lines within the MTA district. An express bus system to Downtown Boston has also been considered for the communities southeast of Boston and a new rapid transit line in the median strip of the Southwest expressway has been discussed. The Massachusetts Department of Public Works has raised the possibility of constructing a $234 million radial and circumferential monorail system in and around Boston.[21] Rail commuter service with dieselized or electrified Budd car equipment that would link with existing railroad terminals in Downtown Boston has also been proposed for transportation districts to the west and southeast of Boston. In this regard, a unified rail commutation service has been suggested that would involve construction of a direct rail link between North and South Stations.[22]

A. *Plans and Proposals*

A valuable source of information on the use of public transportation is available from the 1960 U.S. Census of Population. Data on the proportion of the workforce commuting by public transportation is presented in Figure 45. The highest proportion of transit users is found in the core portions of the region. Relatively few workers rely on public transportation in the outlying and suburban communities, including such sizeable urban centers as Brockton, Lowell and Lawrence. The effects of suburban rail commuting show up clearly on this map in the form of radial patterns of relatively high public transportation use toward Reading in the north and Wellesley-Natick in the west. The map indicated that communities which have rapid transit facilities made considerable use of them but usage falls off rapidly as the distance from facilities increases.

The principal proposals for physical changes and for extensions in the public transportation system are the 1926 transit plan of the state Division of Metropolitan Planning[23] and the 1945 and 1947 reports of the Metropolitan Transit Recess Commission[24] or Coolidge Commission (Figure 46). Summaries of the principal findings and recommendations of each of these reports contained in an earlier publication in the Boston Regional Survey[25] are reprinted as follows:

1. Division of Metropolitan Planning. *Report on Improved Transportation Facilities in the Boston Metropolitan District.* Boston: Commonwealth of Massachusetts, December, 1926.

OBJECTIVE: This study developed a plan for the extension of rapid transit facilities to serve the Metropolitan District and a program for continued public supervision of the Boston Elevated Railway.

RECOMMENDATIONS: The recommendations of the study concerned extension of physical facilities and reorganization of the financial structure and supervision of the elevated system.

New Rapid Transit Routes. A long term plan for the development of five through transit routes was proposed. Two of the routes, East Boston to Brighton and Lechmere Square — Huntington Avenue, were recommended for immediate completion. No time table was proposed for the remainder of the system. However, the Revere Beach, Chelsea, and North Cambridge extensions were given high priority. It was noted that a circumferential rapid transit route connecting the proposed radial routes might someday be necessary. This recommendation was originally made by the Transit Department of the City of Boston in 1923.

Park Street Station. It was proposed that the East Boston Tunnel be extended to Park Street Station and that the station be converted from a terminal to a way stop.

20. Henry D. Quimby, "Major Urban Corridor Facilities, A New Concept," *Traffic Quarterly* (April, 1962).
21. Charles R. Ashley, "Monorail Proposed," *Rod and Transit*, Massachusetts Department of Public Works, Vol. 2, January, 1962, p. 6.
22. See James L. Lee, "The Old Colony Transportation Problem," *Traffic Quarterly* (Saugatuck, Conn., July, 1961), pp. 461-479, and Stanley Berge, "How Commuters Can Have Their Trains," *The Atlantic Monthly* (May, 1960).
23. *Report on Improved Transportation Facilities in the Boston Metropolitan District*, Division of Metropolitan Planning, Commonwealth of Massachusetts (December, 1926).
24. *Report of the Metropolitan Transit Recess Commission*, Commonwealth of Massachusetts (Boston: April 2, 1945 and April 1, 1947).
25. *The Boston Regional Survey: A Bibliography of Planning Studies of the Boston Metropolitan Region*, prepared by MTC Planning Consultant (Cambridge, May 1, 1962).

Atlantic Avenue. It was proposed that the city of Boston purchase the Atlantic Avenue elevated structure and convert it into an elevated highway.

Metropolitan Transit System. The report proposed that a new corporation, the Metropolitan Transit System, be established to purchase the assets of the Elevated Company. The Board of Directors of the new Corporation would be appointed by the Governor, and the Commonwealth would guarantee a fixed return on the stock. A 40 to 50 year period of public control was recommended. This plan to extend the Public Control Act of 1918 was chosen from several alternatives on the grounds that it was economically feasible and did not increase the extent of public ownership.

METHODS: The methodological approach of this study consisted of a review of data on the operations and use of transit facilities for the period 1920-1925, identification of current trouble spots in the system in terms of decline of use of some facilities and inadequacy of others to meet current demands, and a very general estimation of future trends.

The proposal for extension and improvement of the transit system was made under expectations of:

1. Declining use of steam railroads for commuter service.
2. Increased use of buses for transit service.
3. Increased use of private automobiles for commuting. (It was assumed, however, that improved transit service could offset this trend.)

SIGNIFICANCE:

This study played an important role in establishing a framework for public operation of the Boston area's rapid transit system. Many of its recommendations were subsequently carried out, although in modified form. While some of its assumptions about future travel patterns have proven over-optimistic (especially with regard to the ability of the transit system to overcome the trend toward increased automobile use) it comprised a well-conceived plan, even in light of the many regional changes that have occurred in ensuing decades.

To a greater extent than the subsequent Coolidge Commission studies (see below), this effort by the former Division of Metropolitan Planning undertook a comprehensive analysis of the existing rapid transit system, with relatively less emphasis being placed on detailed supporting data for extensions of the system.

2. *Report of the Metropolitan Transit Recess Commission.* Boston: Commonwealth of Massachusetts, April 2, 1945 and April 1, 1947. (Also known as "Coolidge Commission Reports.")

OBJECTIVE: The Commission was charged with preparing a comprehensive plan or plans for the development of rapid transit in the Boston metropolitan area, including proposals for new routes, delineation of the district to be served, and recommendations of legislation to effectuate the proposals.

RECOMMENDATIONS: Proposals for reorganization and integration of rapid transit service and substantive proposals for extension and improvement of transit routes were made in the Commission's 1945 report. These were subjected to further study, modifications were made, and the final proposals were presented in the 1947 report. These included:

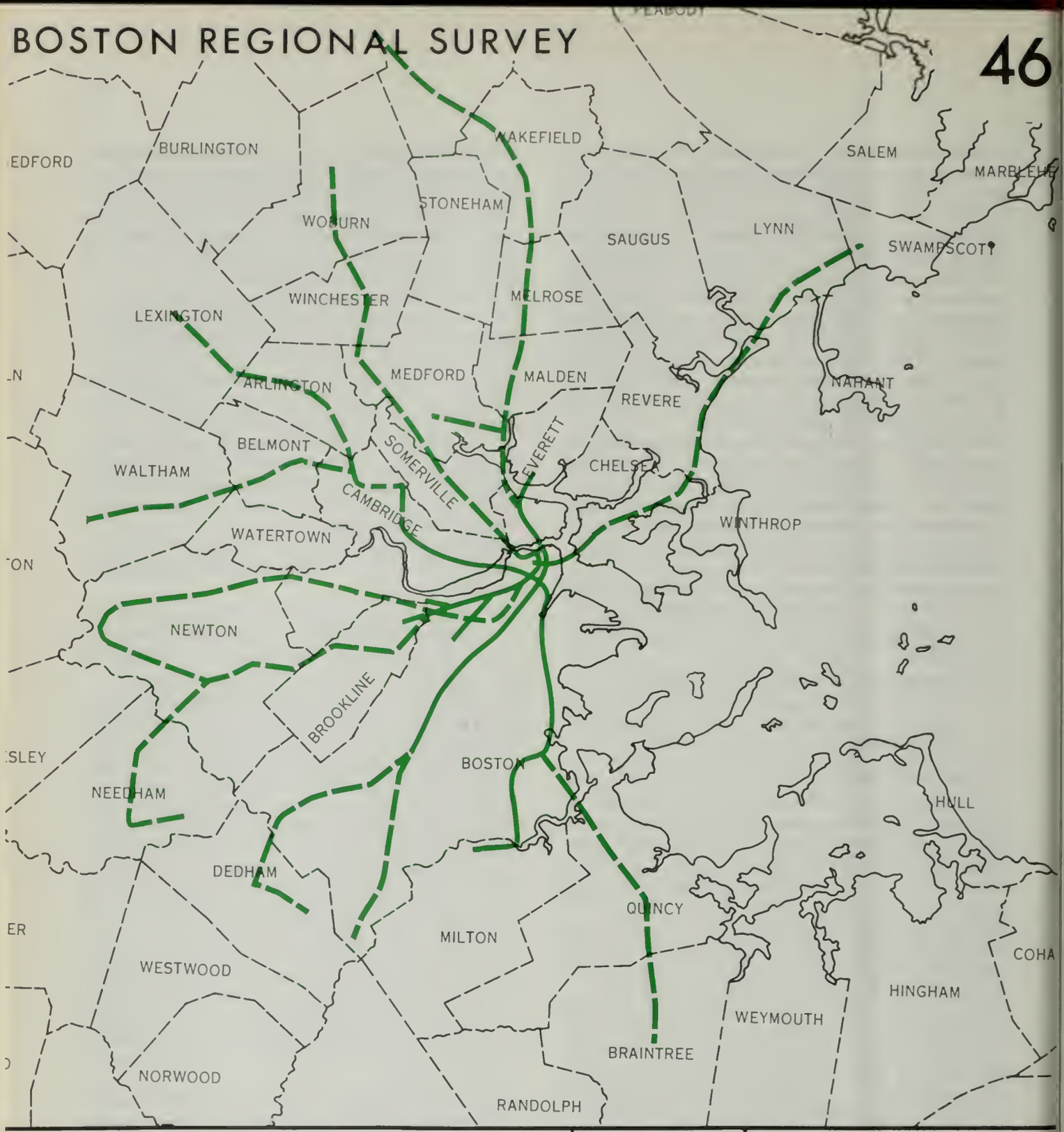
Public Ownership of the Boston Elevated Railway. It was strongly recommended that public ownership of the Elevated be completed by purchase of the company's stock according to the option of the Public Control Act. This step was proposed as a financial saving to the Metropolitan District and to create the nucleus of the proposed public-owned rapid transit system.

Metropolitan Transit Authority. A transit authority managed by public trustees appointed by the Governor and including all of the towns and cities served by the rapid transit system was proposed to construct, control, and operate the system.

Proposed Transit Routes. The route proposals contained in the 1945 report and their 1947 modifications, included:

1. Braintree-Savin Hill Route. Extension of the Cambridge-Dorchester subway from Savin Hill to South Braintree via the tracks of the Old Colony Division of the New Haven Railroad.
2. Harvard Square-Arlington Heights Route. Extension of the Cambridge Subway from Harvard Square under Massachusetts Avenue to Porter Square and thence via the tracks of the Fitchburg Division, Boston and Maine Railroad, to a terminal located between the Concord Turnpike and Alewife Brook Parkway. Extension of service to Lexington Branch, Boston and Maine Railroad, was also proposed, as was extension of service from the proposed West Cambridge terminal to Waltham Highlands via the right-of-way of the Central Massachusetts Railroad.
3. Forest Hills-Dedham Route. Extension of the Everett-Forest Hills line via the tracks of the West Roxbury Branch, New Haven Railroad, to a terminal in East Dedham. It was also proposed that the elevated structures on the Washington Street section of the existing line be replaced by a subway.
4. Forest Hills-Hyde Park and Readville Route. Extension of the Everett-Forest Hills line from the Forest Hills station to Readville via the right-of-way of the New Haven Railroad. A possible connection of this route with the Forest Hills-Dedham route to provide loop service was suggested.
5. Sullivan Square-Reading Route. Extension from Sullivan Square to Reading Highlands via the right-of-way of the Western Division, Boston and Maine Railroad. A branch from this line at Medford Junction to Medford Square via the tracks

BOSTON REGIONAL SURVEY



1947 TRANSIT PLAN

AS PROPOSED BY THE COOLIDGE COMMISSION

EXISTING TRANSIT ROUTES (1947)

PROPOSED EXTENSIONS

GENERAL INFORMATION

EXPRESSWAYS
UNDER CONSTRUCTION
PROPOSED
MAJOR HIGHWAYS
SECONDARY HIGHWAYS
MAJOR RAILROADS
SECONDARY RAILROADS
RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM 5 SHOWN ON MAP

NORTH

1 SQUARE MILE

0 MILES 5

PREPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954 AS AMENDED

of the Medford Branch, Boston and Maine Railroad was also proposed.

6. Lechmere-Woburn Route. Extension from Lechmere Station to North Woburn via the right-of-way of the New Hampshire Division, Boston and Maine Railroad.
7. Tremont Street Subway to Riverside. Extensions of the Tremont Street subway to Riverside via the local passenger tracks on the main line of the Boston and Albany Railroad.
8. Kenmore-Riverside-Needham Junction Route. Extension from the subway under Beacon Street to Riverside (forming a loop with the Tremont Street Subway extension) by way of Newton Highlands via the Highland Branch, Boston and Albany Railroad. A branch from this line just west of Newton Highlands (Cook Junction) to Needham Junction and Birds Hill was also proposed.
9. Maverick Square-Lynn Route. Extension from Maverick Square to Orient Heights and then to Lynn via the right-of-way of the Boston and Maine Railroad and the former location of the Narrow Gauge Railroad. Construction of the segment from Maverick Square to Orient Heights had been authorized subsequent to the filing of the 1945 report.

Feeder Services. It was recognized that a system of feeder bus lines integrated with the transit system to bring passengers to the terminals and stations would be essential. It was recommended that jurisdiction over these lines and over all bus and trolley lines within a proposed ten mile zone be granted to the proposed transit authority. Automobile parking facilities at outlying terminals and stations were recommended.

METHOD: The original study which resulted in the 1945 report reviewed the existing system and trends in transit use and population movements and growth. Estimates of the number of riders who would be attracted to the proposed transit extensions were developed as follows:

1. It was assumed that approximately the same number of persons using steam railroad and bus facilities for commuting prior to World War II would use rapid transit in the postwar era. These data were available from a June 1941 survey by the State Department of Public Works.
2. To estimate the number of new riders that would be attracted to the transit extensions, a study was made of the results of the transit extension to Ashmont. On this basis is was concluded that a twelve per cent increase over steam railroad and bus commuter could be expected. This was applied as a standard expansion factor to the DPW data in estimating the number of riders on the proposed routes.

Modifications made in the 1947 report were largely based on the results of public hearings held after release of the 1945 report in cities and towns that would be affected by the proposals.

SIGNIFICANCE:

The Coolidge Commission reports remain the most recent comprehensive study of the Boston area's mass transit system and needs. The studies were instrumental in achieving the shift from a mixture of private and public ownership to public control of the metropolitan transit system. The Commission's assumptions about future population distribution did not fully take into account the pace and extent of postwar suburban growth and core area population losses. However, this may have been due in part to the fact that many of the Commission's recommendations for transit extensions were not executed. Pending a current, comprehensive survey, such as is now in progress by the Mass Transportation Commission, and the Department of Public Works, these studies still constitute the principal regional plan for public transit.

B. *Central Business District*

It is useful to consider the transit improvements recommended for the center of the MTA rapid transit system because even if a few of the many proposed transit extensions were to be carried out, existing deficiencies in capacity at the focal point of the MTA system would be aggravated by the large traffic volumes generated by new extensions.

The 1926 transit plan proposed two basic solutions for the capacity problem at the center of the transit network: through routing and conversions of a part of the streetcar subway to regular rapid transit cars. The turnaround terminal loop of the East Boston line would be eliminated and the East Boston line would be extended to Park Street station and the Boylston Street subway by constructing a new tunnel under Beacon Hill. The route would proceed through the Boylston Street subway out along Commonwealth Avenue to a westerly terminus at Lake Street. Another through route would extend from Lechmere to a terminus at Huntington Avenue and Tremont Street in Roxbury. The route would use the existing causeway and tunnel to the exit of the Tremont Street subway at Broadway. The line would then proceed via a short subway extension to Arlington Street, surfacing and paralleling the New Haven tracks and then connecting to a reserved way on Huntington Avenue.

The 1945 Coolidge Commission report, seeking to remedy the lack of adequate track and loading space at two downtown stations, recommended enlarging and consolidating Park and Boylston Street stations with facilities for four tracks and two parallel platforms running the entire length of Tremont Street between the two stations. The report also recommended a new tunnel from Park Street to Scollay Square station at the head of Hanover Street. This new connection would aid in the extension of rapid transit to the north of Boston. The new tunnel, in conjunction with the subway from Park Street to Scollay Square under Tremont

Street, would form a four track connection through the center of the city. It was believed that these major improvements, along with the elimination of branch streetcar surface routes, would improve the efficiency and capacity of the center of the system.

A 1955 planning study for the New England Medical Center[26] in the South Cove, discussed one possibility of removing the Washington Street elevated in the vicinity of the medical center and shifting it underground. The study noted, however, that the chance of such improvement in the immediate future was unlikely because of the great expense and because it would produce only indirect benefits to the transit system.

The construction of the new $299 million Prudential Center in Back Bay and the redevelopment of the Scollay Square area for a new Government Center prompted the MTA in 1959 to make a study on how best to serve these two new concentrations of activity.[27] The study essentially reaffirmed the 1945 Coolidge Commission proposal for a new connection between Park Street station and Scollay Square, but it was noted that exact details of the plan would have to await completion of the final Government Center site plans. A higher priority was therefore given to transit improvements proposed for the Prudential Center which was closer to actual realization. The study proposed a subway less than a mile long under Stuart Street, extending from the Tremont Street subway exit to a point on the Huntington Avenue subway. Two new stations would be constructed to serve portions of the Back Bay Business district along Stuart Street, and the South Cove-entertainment area which now receives only peripheral service. Physical improvements to three stations in the immediate vicinity of the Prudential Center were also proposed. The total cost of these improvements was estimated to be about $21 million.

No action was taken on Prudential transit plans possibly because of the expense of the undertaking and partly because the Prudential Insurance Company took no steps, in public, to insist on the plan.

With final site plans for the Government Center completed, and with the construction phase in progress, MTA plans for the center may begin to be realized early in 1963. The MTA will launch a $3.3 million project to construct an 800 foot tunnel to act as a short cut from Scollay to Haymarket Square with the Boston Redevelopment Authority paying 84% of the cost. Scollay Square station, together with a new turn-around loop, will be rebuilt and located slightly north of its present location. The present loop through Adams Square will be eliminated. Completion of the project is expected to pave the way for the eventual substitution of rapid transit trains for trolley cars in the subway.

26. Kevin Lynch, *Medical Center in the South Cove, A study for the Development of the New England Medical Center and Its Neighborhood* (December, 1955), p. 29.
27. Metropolitan Transit Authority, *Report Regarding Proposed Subway Facilities Required to Meet Additional Loads from the Prudential and Government Center Projects* (Boston, March, 1959).

A 1960 planning study for the North Station area recommended removal of the North Station-Lechmere elevated trolley lines because of its blighting effect on development and expansion of the North Station commercial district.[28] Further study of the North Terminal Area project has been conducted as a joint effort by a number of state, local and private agencies. While this study is primarily concerned with the transportation problems of the area south of the Mystic River to the Charles River Basin, one of its major elements is development of plans for replacement of the elevated MTA line through Charlestown.[29] This was considered in conjunction with an extension of rapid transit to Reading over Boston and Maine tracks. The MTA 1961 annual report lent additional support to this proposal. The proposed MTA project includes razing the elevated structure from North Station to Everett and construction of an extension through the Boston and Maine yards. The proposed line would have a subway station at North Station along with two other stations in the North Terminal Area and would cross the Charles River via a bridge or tunnel.

A general plan for Boston's central business district, published in 1960, summarizes transit improvements under consideration for the central business district.[30] In addition to those proposals already mentioned in this section, the report mentions two new alternatives. One is the utilization of the Boston and Albany right-of-way from the Tremont Street tunnel to Riverside. The new route would give the Prudential Center direct rapid transit access and connect to Lechmere by a system of through routing with possible extension to Woburn. Regular rapid transit trains would substitute for streetcars in the tunnel. However, the use of the major portion of the Boston & Albany right-of-way by the Massachusetts Turnpike Authority makes the adoption of this proposal extremely unlikely. Another alternative suggests the possibility of eliminating the Washington Street elevated by substituting direct connection to the New Haven Railroad right-of-way.

5. OTHER PUBLIC TRANSPORTATION IN THE BOSTON REGION

A. *Introduction*

Buses are the principal form of public transportation in areas outside the 14-community MTA district. Under the conditions of low population densities in suburban areas, buses are superior to other forms of transit because they are more flexible and provide greater scope of coverage with a minimum investment in fixed plant equipment. Despite the operational advantages of buses for intra-urban travel in outlying areas of the region,

28. *A Planning Study of the North Station Area, Boston, Massachusetts*, prepared by Advance Planning Associates for the North Station Merchants Association (August, 1960).
29. *North Terminal Area Study*, North Terminal Area Study Committee (October, 1962).
30. *A General Plan for the Central Business District*, Boston Redevelopment Authority (Boston, 1960), pp. 34-36.

patronage of intra-city bus companies has declined, primarily because of competition with the private automobile. Buses cannot match the speed and convenience of door-to-door travel that automobiles afford. Increasing use of the automobile creates growing traffic congestion on city streets which further reduces the efficiency and speed of local bus service.

In general, the decline in local bus patronage contrasts sharply with the steady gains in ridership levels achieved by large intercity bus companies. In recent years intercity buses have increased their share of the total intercity travel market in competition with railroads and airlines. Intercity buses provide much greater speed, efficiency and convenience than intracity buses because they can take full advantage of the federally aided expressways and turnpikes between major cities. Suburban buses in outlying areas of the Boston region are slower because local buses share ordinary urban roads with other traffic and partly because of a large number of time consuming local stops. Moreover, important urban links in the region's interstate highway system have not yet been constructed and for a number of reasons buses do not make full use of those portions of the expressway system which have been completed.

B. *Bus Service*

There are three major categories of bus service:

a. Local or suburban bus transportation is comparable to true mass or public transportation. Frequently, scheduled buses make many stops on local and collector streets serving city centers, neighborhoods, and whole towns. Although their scope of coverage is usually limited, there can be wide variations in size of service area. For instance, a local bus company may serve only a single town or city. However, urban areas with well developed downtown centers surrounded by high density residential areas and functionally related suburbs may require more extensive service than a single suburban town.

Local bus companies often serve a group of contiguous towns along one travel corridor, providing intercommunity service among adjacent communities with only indirect connections to Boston. The majority of local or suburban companies fall in this category.

b. *Intercity* bus transportation is provided on main arterials over longer distances to connect major cities. Stops are kept to a minimum and are limited to areas of major population concentration or convenient focal or collector points on the highway system. There is some variation however, in length of distance traveled and number of local stops. Buses with a franchise for interstate travel often concentrate exclusively on long distance trips between centers of large cities and use suburban stops only for the convenience of long distance travelers and will not pick up or discharge local passengers.

In between the two extremes of travel cited above, some bus companies provide a mixture of *intercity* and *local* service. Mixture of service is particularly likely to occur in eastern Massachusetts where there is one large metropolitan area surrounded by a series of closely spaced central cities and metropolitan area. As intercity buses approach the central city of a large metropolitan area they travel a considerable distance through densely settled areas of urban population. There is a tendency for intercity bus lines to increase the number of local stops on this part of their run to accommodate the increasing number of people that desire to travel to the central city. There are a number of examples of such mixed service in the Boston Metropolitan Region.

As independent bus companies approach or cross the MTA service district there is competition among these companies and the MTA in providing local service to the same area. Conflicts are frequently minimized by restriction or integration but in some instances there is direct duplication of service.

Most local bus companies traveling from areas outside the MTA district to Downtown Boston and vice versa operate under franchise regulations that restrict them from providing local service in the MTA area. Restrictions are applied in several ways. Buses travelling to Boston may only stop in the MTA area to discharge passengers and buses traveling from Boston may stop only to pick up passengers. The net effect is that no local passengers are carried between points located entirely within the MTA areas. Sometimes independent bus company fares are so high that local travel between points in the MTA area is prohibitive. Other restrictions are applied when fringe community residents outside the MTA area find independent bus service or travel to outlying MTA terminals equally attractive. For example, to the southwest of Boston, passengers from Westwood traveling to Boston on Johnson Bus Lines (Interstate-local from Woonsocket, R. I.) must leave the bus at the MTA Forest Hills rapid transit terminal. The same buses, outbound from Park Square, Boston, will take on passengers for Westwood at the MTA Forest Hills terminal or Dedham Square.

Suburban bus companies are prevented from making competing runs on expressways to the city center. However, the Plymouth and Brockton Street Railway uses the Southeast Expressway from Hingham to Boston because the area is largely outside the MTA district and the competitive market in the fringe communities of Quincy and Braintree is not served by the run.

The most common method of avoiding direct competition within the MTA areas is for independent bus companies to make indirect connections to Boston. Bus lines stop at the boundary of the MTA district at one of the MTA rapid transit terminal stations and passengers transfer to MTA rapid transit lines to complete the trip to Boston.

Three bus terminals in the Boston Central Business District accommodate intercity buses traveling to Bos-

ton. Although the primary function of these terminals appears to be to accommodate interstate and state intercity bus lines, a number of bus companies that use these terminals provide suburban and intercity service *within* the region. The Eastern Massachusetts Street Railway Company terminates its runs to Lynn, Marblehead, Salem and Lawrence in Haymarket Square in Boston. Two bus terminals are located a block apart in the Park Square area of Boston.

All the terminals are located near MTA rapid transit stations in crowded built-up areas at the periphery of the central Business District. The Eastern Massachusetts terminal is merely a shed on a traffic island and does not meet the requirements of a major bus terminal. Loading facilities at the other two terminals are barely adequate for the intercity travel they now serve. Since buses approach the terminals through congested streets, much of their total travel time is consumed by delays in local traffic. The location and capacity of present bus terminals is not adequate to handle suburban public transportation. A consolidated bus terminal with adequate station passenger capacity, bus loading facilities and a specialized roadway would be necessary if suburban bus transportation to Boston were to be instituted on a large scale. For instance, technical consultants considering a bus system to Boston from the Southeastern communities formerly served by the New Haven Old Colony railroad concluded that ". . . a modern off-street bus terminal in downtown Boston would improve the efficiency of the operation, in fact, it would be almost indispensable to its success . . ."[31] The report also noted that buses operating at frequent intervals during rush hours in downtown streets stopping frequently to discharge and pick up passengers would increase delay on downtown streets for other vehicles. It is reasonable to expect that these same disadvantages would apply for any proposed increase of suburban bus service to Boston from other outlying areas of the region.

Table 57 shows the operating ratios of major independent bus companies in the Boston region. The operating ratio is the relationship between total cost of operation and total income from the operation before federal income taxes.[32] (The lower the operating ratio, the

31. DeLeuw, Cather and Company, *Report to the Old Colony Area Transportation commission on Plans for Improved Suburban Transit* (Brookline, (April, 1959) p. 39.

32. "The numerator represents expenses (maintenance, garage expense, transportation, insurance, safety, administrative and general depreciation, operating taxes, licenses and rents paid and the denominator represents revenues (fares from regular service, chartered service, advertising and rentals from operated property)." *Report of the Special Commission Relating to Local Transit Companies*, Commonwealth of Massachusetts (Boston, December, 1956).

TABLE 57

FINANCIAL STATUS OF STREET RAILWAYS AND BUS COMMON CARRIERS, 1955 and 1960

Street Railways	Expenses	Revenue	Operating Ratio 1960	1955
Boston, Worcester and New York	957,489	992,208	96.5	96.5
Eastern Mass.	6,796,000	6,986,000	97.3	94.7
Middlesex & Boston	1,731,000	1,776,000	97.5	99.1
Plymouth & Brockton	300,899	360,123	83.5	104.2
Bus Common Carriers (over $100,000 gross revenue)				
Almeida Bus Lines	448,897	489,497	91.7	102.3
Brush Hill Transportation Co.	179,713	179,704	99.7	106.5
Carlstrom Bus Lines	145,274	151,936	95.6	100.0
Gloucester Auto Bus	180,652	199,024	90.8	103.1
Hudson Bus Lines	375,444	383,268	98.0	97.3
Hudson Bus Lines, Inc.	358,488	390,448	91.8	105.5
Johnson Bus Lines, Inc.	429,300	415,700	103.3	100.5
Lynnfield Community, Inc.	157,523	147,457	106.8	95.4
Mass. Northeastern Transp. Co.	377,617	386,861	97.6	102.4
McIntire Bus Lines	112,571	112,679	99.9	105.6
Michaud Bus Lines, Inc.	376,176	387,826	97.0	100.6
Peter Pan Bus Lines	621,790	751,018	82.8	98.1
Rapid Transit, Inc.	232,717	235,192	98.9	102.7
Service Bus Line, Inc.	189,657	190,424	99.6	102.6
Trailways of N.E., Inc.	2,469,458	2,693,759	91.7	101.5
Vermont Transit Inc.	1,538,439	1,621,755	94.9	96.8

Source: Mass Transportation Commission, *Staff Study*, September 27, 1961.

higher the rate of return over and above operating costs.) In 1955, few of the independent bus companies in the region showed an operating profit but by 1960 the situation had improved substantially; few of the independent bus companies showed an operating loss. Despite this improvement, however, most of the companies have operating ratios of 95% or more, indicating an extremely small margin of profit. The Eastern Massachusetts Street Railway Company, the largest independent bus company in the region, carrying about 300,000 daily passengers in 81 cities and towns north, west and south of Boston, showed a relative worsening in its financial position. The company suffered a loss of nearly $70,000 in 1961, although there are indications that the firm will show a profit in 1962.

Aside from competition from private automobiles, the financial plight of the independent bus companies is attributed to rising costs of operation, especially wages; unattractiveness and near obsolescence of equipment; loss of patronage due to fare increases (every 1% increase in fares is said to result in a one-third of 1% loss in passengers); the excise tax assessed on buses which discourages the purchase of new equipment and inflexible Department of Public Utilities regulations which hinder rapid revisions in fare structures.[33]

A number of changes in state administrative and fiscal regulations have been suggested as one method of improving the private bus companies' financial position.[34] Recommendations include the elimination or reduction of fuel taxes, vehicle excise taxes, vehicle registration fees, and gross tax receipts and the modernization of regulatory procedures to allow greater management flexibility. Improvements in municipal traffic controls to increase the speed and efficiency of local bus operations have also been suggested including providing reserved transit lanes in all types of right-of-way to prevent interference from other vehicles; timing of traffic signals to facilitate transit movement; strictly enforced parking restrictions and elimination of all double parking; adequate street widths with recessed bays for buses and transit loading zones of correct operating length; restriction of turning movements on transit streets; and staggered working hours.

Bus transit operation on expressways has been recommended to reduce the travel times of buses to and from the downtown area.[35] Permitting buses to operate on expressways would increase expressway passenger carrying capacity. Buses could circulate as feeders on local collector streets and then enter the expressways to complete the major portion of the trip or bus operation could be confined entirely to the expressway with feeder bus lines transferring passengers at interchange points. In either case, providing means of access on or off the expressway and facilities for convenient passenger discharge or entrance is crucial. These facilities can be obtained by providing recessed bays on the expressway with convenient pedestrian access or by providing adequate ramps, service roads and loading bays in the vicinity of the expressway interchange.

Although the limited access design of expressways permits higher speeds and more frequent scheduled headways, thus increasing the capacity and convenience of bus service, there are some factors that may prevent these operational advantages from being achieved. Portions of the expressway system near downtown are already filled to capacity by automobiles during the crucial peak hour rush. Moreover, frequent rapid service on freeways requires adequate capacity on ramps or collector streets in the vicinity of the expressway. When ramps and collectors are inadequate, especially in peak hours in or near downtown, pile up of express buses on freeways and ramps may occur. Buses operated on frequent headways may seriously reduce the already inadequate capacity of downtown streets for other vehicles. In addition, it may be difficult to provide convenient passenger access or bus loading facilities on existing expressways and interchanges.

Municipal ownership or subsidy has been suggested as another alternative for improving the financial condition of local bus companies. The assumption is that low priced and convenient service could be maintained or improved if the public pays part of the operating cost out of general tax revenues. Other suggestions for improved service and competitive operations involve direct action by transit companies. These include initiation of club-bus operations; special home-to-factory express services; park-ride facilities; and express buses that pick up passengers in a limited area on a regular route and then operate nonstop to downtown.

Many of the recommendations outlined above have been adopted elsewhere in the nation. Nashville and Baltimore have successfully used reserved bus lanes. Special bus roadways have been proposed for bus rapid transit to and from central areas in St. Louis and Washington, D. C. Express bus service has been used in Detroit and Chicago for many years. Club-bus service has been operating in Cincinnati. Home-to-factory bus service has been tried in Akron, Ohio. Boston has adopted a park-ride operation for its rail rapid transit facilities. Limited circumferential bus service for industrial areas along Route 128 was offered for a short while but was discontinued when demand slacked off. Trenton, Kansas City and St. Louis have been leaders in promotional bus service for shopping. Philadelphia and Toledo have banned curb parking on transit streets. However, there is no general consensus on the general effectiveness of the innovations in bus service. Some experts feel they have only been applied on a piecemeal basis and do not, as

33. *Report of the Special commission Relating to Local Transit Companies, op. cit.*
34. "Local Public Transportation in New England," Public Transportation for New England, New England Governors' Conference, Report No. 3 (November, 1957), p. 26.
35. Stuart Mill Bates, "Express Bus Service on Freeways," *Traffic Quarterly* (Saugatuck, Conn., July, 1954), pp. 325-333, and "Local Public Transportation in New England," *op. cit.*

yet, provide an integrated solution to the basic problems plaguing public transportation.

A number of conclusions can be drawn from a review of bus transportation in the Boston region.

1. Competition between the MTA and independent bus companies results in restrictions that prevent use near potential capacity.

2. Fares on independent bus company feeder lines are necessarily higher than comparable MTA feeder bus service, resulting in higher charge for a bus-rapid transit combination trip. This tends to discourage the use of public transportation to Boston from areas outside the MTA district.

3. Many small suburban companies have duplicating and overlapping service areas. In addition, in some cases the service area is too small for profitable operation or good public transportation service.

4. A good many suburban bus companies have no direct connection with Boston or any systematic connection with one another. In short, a convenient, integrated local bus transportation system in outlying areas connecting with the center of the region is lacking. (The recently undertaken MTC demonstration program has, as one of its objectives, better integration of rapid transit, bus and railroad service.)

CHAPTER FIVE — RAILROADS

INTRODUCTION

In recent years, the financial position of the railroads as well as their effect on the economy of the region have changed drastically. Rail services once considered essential have declined. Large segments of trackage have been abandoned. Passenger service has been discontinued on many lines still used for freight, and there has been a distinct trend in the reduction of passenger service coupled with increases in fares.

Yet despite the consistent decline of passenger volumes and subsequent reductions in service, the railroad system occupies an important place in the life and economy of the region. Since abandonment of the rail system would have extremely serious effects, feasible methods of restoring vitality to the region's railroads require careful study.

1. HISTORY

A. *Introduction*

Railroads radiating out of Boston had a profound influence on the core of the central city and the metropolitan pattern of development. In the 19th century, the railroads not only helped to bring Boston into a closer, more complex relationship with a broader regional hinterland, but also stimulated geographical expansion of Boston into its immediate environs. New suburbs and industrial satellites were established as the railroads improved the accessibility of areas adjacent to Boston. The city expanded in a star-like fashion along railroad rights-of-way. Formerly isolated towns and villages became way stations on rail lines and developed into more concentrated clusters. Although some of these towns retained their independence from Boston, they became part of Boston's immediate hinterland. These events foreshadowed large scale commutation, the movement of tens of thousands of persons to and from the new suburbs. Important as all these local developments were, however, they were incidental to Boston's inter-regional competitive position.

B. *Railroads and the Internal Structure of the City*

a. *Indirect Economic Impact*

The railroads enhanced Boston's commercial position as a point for the trans-shipment of goods by allowing commodities coming in and out of the port to be traded over a wider area. Boston necessarily developed on the seacoast, concentrated on trade over ocean routes. Boston's fine protected harbor was situated at the confluence of several rivers which permitted some access to a small hinterland. Commodities carried in ocean-going vessels were unloaded at Boston and easily trans-shipped upriver in shallow draft vessels. Later, roads and canals helped to expand Boston's hinterland.

A large population settled in Boston at this natural break in transportation to service and facilitate the trans-shipment of goods. Centers of commercial activity, residences, roads — all oriented to the port — huddled close by the waterfront in a dense pattern.

b. *Direct Physical Impact*

Whereas the physical linkage between ocean, river, road and dock was relatively simple, the complex technology and the physical characteristics of the fixed railroad right-of-way made railroad connections more difficult. More land, stronger piers and larger storage facilities were needed to accommodate both the restricted radius of curvature of the railroad sidings and the increased goods-handling capacity inherent in the railroad (as opposed to carts and wagons). The fixed railroad right-of-way and long railroad trains required separate rights-of-way for efficient operation, which were difficult to obtain in the crowded waterfront sections of the city.

There were also conflicting tendencies between the freight and passenger functions. Passenger stations were located at the periphery of the central business district. These stations became the new gateways to the city and reduced the railroads' close physical orientation to the waterfront.

A new phenomenon peculiar to railroad technology was the requirement of large railroad storage and classification yards. At terminal destination points, trains had to be classified, broken down into cars and reassembled according to whether goods were to be trans-shipped to local market, rerouted to more distant points, or transferred at piers for ocean shipment. Yard operations were a space-consuming, costly operation necessarily located outside the dense central business district.

Another problem arose from the requirement for transfer points among different railroads converging at or near the center of the city. A great portion of the business of individual railroad companies was conducted with other railroads in order to make through connections to places beyond their territory. In addition, private shippers as well as railroads, owned terminal piers scattered at various points along the waterfront. These different systems had to be physically linked and most of the physical connections had to be made within the region's core area.

c. *Boston: Physical Impact of Railroads*

The serious problem the railroads had in adapting to the internal structure of Boston is reflected in the history of railroad construction in relation to the unique topographical characteristics of Boston proper. Originally Boston was located on a small, hilly peninsula connected to the mainland by a narrow isthmus. Other peninsulas nearby jutted into the harbor and the entire basin shoreline was indented with bays, coves and inlets. Boston's waterfront was already built up with wharves constructed during the ara of active ocean commerce prior to the coming of railroads. Dense commercial and residential areas concentrated around the waterfront, crowding and impinging upon its port-oriented activities.

Waterfront facilities, already obsolete by railroad standards, were crowded and indequate for transferring and storing cargoes. Under these conditions, Boston provided space for railroad extensions, yards, depots and warehouses (as well as for commercial and residential uses) by leveling hills and filling in coves, bays and inlets. Figure 47 shows the physical impact of railroads on central Boston.

Four railroads approached Boston from the south and west, all terminating in the general vicinity of South Cove. Two lines, one from Worcester in the west and the other from Providence in the south, crossed an artificial basin in the area to the west of Boston between Brookline and the city proper. Two other lines, the Old Colony from Plymouth and the so-called Midland or Boston-New York Central route entered Boston via South Boston bridging parts of the South Bay and also, in the case of the latter, Boston Harbor.

From a point in Brookline, the Boston and Worcester ran on embankment fill diagonally across the basin in a northwest-southeast direction to Castle Street and then to its passenger station near the present South Station. A subsidiary of this railroad filled in the South Cove area of Boston to build a wharf and terminal facilities on the land. From Roxbury, the Boston and Providence railroad cut diagonally across the basin from the southwest to the northeast proceeding to its passenger station in the Park Square area of Boston. This line intersected the Boston and Worcester at a point in mid-basin near what is now Back Bay Station. The intersection of the two lines gave impetus for the filling and subsequent development of all the surrounding basin area into what is now called Back Bay.[1]

Four lines running from Lowell, Fitchburg, Salem and Lawrence entered Boston from the north, terminating in the area of Causeway Street north of the business district on land created by filling in Mill Cove. All four lines crossed the narrow Charles River channel separating Boston from Charlestown on parallel bridges.

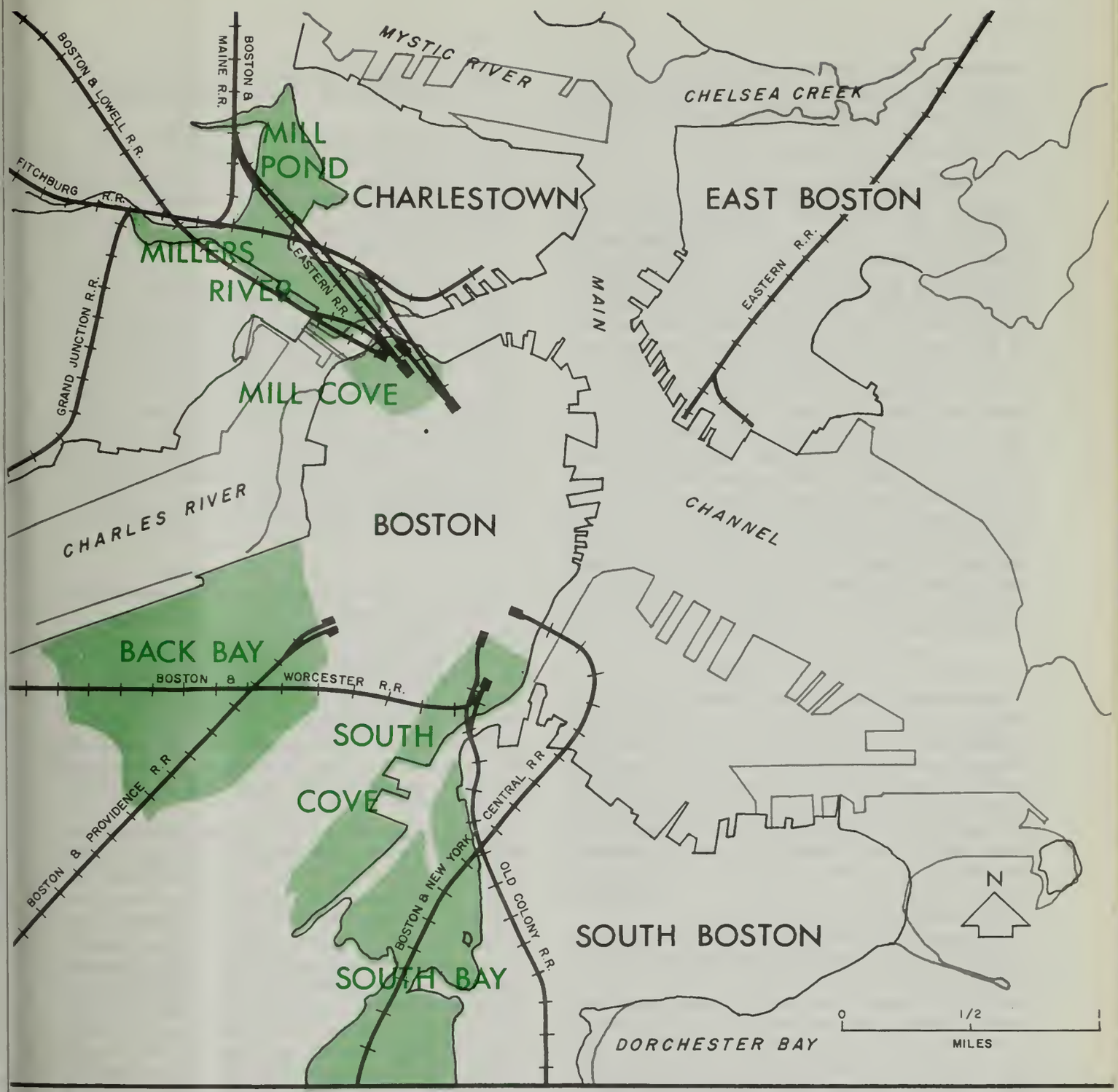
The Boston and Maine located its passenger station in Haymarket Square, but, because rail lines were forbidden on city streets beyond Causeway Street, cars were drawn by horses to the station. The Fitchburg line had an elaborate station nearby, with a large hall for conventions and concerts. The Boston and Maine and the Fitchburg line had by the late 1800's secured terminal facilities in Charlestown away from the crowded city of Boston. Although the new Charlestown waterfront facilities of these lines were also congested, short spurs provided access to other docks and areas with potential for expansion The rail line running along the northeast coast to Salem and Maine had at first secured terminal facilities on the flats of East Boston where Noddle's Island in Boston Harbor had earlier been connected by fill to the mainland. The location was unfortunate since both passengers and freight had to be discharged and transferred by ferry to reach the business section of Boston. Years later the line bought costly land in Charlestown for larger terminal facilities in anticipation of heavy traffic from Maine that was never realized.[2] Finally, the line was able to reroute its track by an indirect route to a station on Causeway Street.

By the middle of the 19th century, eight separate lines had established terminals in Boston. The lines approaching Boston from the south had passenger facilities in the vicinity of South Cove; those approaching from the north terminated in the vicinity of Causeway Street. Thus, it was only natural that the lines to the north of Boston under the Boston and Maine system and the lines to the south of Boston under the New York, New Haven and Hartford and Boston and Albany systems should be incorporated into two physically separated terminals. To the north, the filling of Mill Pond in Charlestown and Miller's River in Somerville provided land for the extensive yards of the Boston and Maine at the junction of Cambridge, Somerville, Boston and Charlestown. To the south, the filled land of South Cove and South Bay provided land near the terminal for the yards of the New Haven system. To the west, the filled land of Back Bay provided space for yards of the Boston and Albany to be used in conjunction with the New Haven. In addition, some lines acquired land for yards farther out in the suburbs.

Because of the numerous coves, bays and estuaries surrounding the city of Boston, considerable expense and filling of land was required to obtain land for the necessary railroad connections and terminal facilities in the city proper. Topographical difficulties and the shortage of land resulted in devious rail connections, scattered waterfront terminal facilities or yards and a number of separate passenger terminal locations in and around the congested portions of the city. These conditions made through connections among the many in-

1. Walter Muir Whitehill, *Boston: A Topographical History* (Cambridge; Harvard University Press, 1959), pp. 95-106.

2. Edward Chase Kirkland, *Men, Cities and Transportation: A Study in New England History*, 1820-1900 (Cambridge, Harvard University Press, 1948), pp. 195-199.



RAILROADS AND LAND DEVELOPMENT IN BOSTON AND ADJACENT CITIES, 1855

RAILROADS
SHORELINE 1855
PRESENT SHORELINE

RAILROAD ORIENTED LAND FILL AREAS

SOURCE: THE COLTON MAP OF BOSTON AND ADJACENT CITIES, 1855, THE BOSTON ATHENAEUM

dependent railroad lines in the center of the city extremely arduous and made full consolidation at the center of the city difficult to achieve.

C. *Railroads and the Metropolitan Substructure*

a. *Early Railroad Construction*

Boston's stature as a center of economic activity depended on the extension of its hinterland and its competitive advantages as a market. The size of this hinterland or market reflected two definite stages in the history of New England railroad construction.

In the first stage of railroad construction from 1830 to 1870, routes were constructed to important independent urban centers such as Lowell, Lawrence, Providence, Fitchburg, Fall River and Worcester. These cities were located more than 15 miles from Boston. At any smaller distance railroads felt the effects of competition from more flexible cart and wagon freight traffic.[3] These urban centers were located at a great enough distance from Boston to exert a dominant influence in their adjacent areas. They had sufficient population and industry to justify a profitable exchange of people and goods with the larger market to Boston. The energies of early railroad entrepreneurs were concentrated on developing and exploiting the traffic potential that already existed between these cities and Boston.

b. *Growth of Suburbs and Satellites*

Early railroad lines to Lowell, Worcester and Providence formed the basic network for the metropolitan railroad system. The industrial activity of the fast developing textile city of Lowell provided the motivation for a rail connection with Boston. Trade between Lowell and Boston had already received impetus from the construction of the Middlesex Canal, but because of severe New England winters canal trade was seasonal. The rail line to Lowell traversed the Somerville and Medford areas adjacent to Boston and thereby stimulated growth of the suburbs to the north.

The growing industrial activity of southeastern Massachusetts and Rhode Island generated demand for a rail extension from Boston to Providence. There was hope that such a connection would make Boston more competitive with the active steamboat trade in Long Island Sound running from New York to Providence.[4] The line running directly south from Boston assisted a spillover of population into what are now the Roxbury, Hyde Park and Forest Hills section of Boston. Higher income suburban developments clustered around more distant stations in Needham and Westwood.

Heavy traffic in wagons and stagecoaches indicated the existence of a substantial traffic potential between Boston and Worcester and intermediate points. Since the natural barrier created by the Charles River hampered the expansion of Boston to the west, independent towns and satellites developed at more distant railroad stations in Newton, Framingham and Natick.

Other extensions radiating from Boston in the early period of railroad construction helped to generate suburban growth. The Old Colony Route was constructed southeast of Boston along the coast to Plymouth and Cape Cod. After it was in operation for two years, the following comments were made about its effects:

> . . . The business of transporting merchandise and passengers has been constantly increasing . . .Not only does it accommodate the people on the whole line, but has the effect of bringing into use lands that would have otherwise remained of little value, and which now have been changed into thriving villages, with healthful indications of a rapid augmentation of property and population. Persons have their family residences at various distances from Boston, and yet conduct their daily operations in town. Such is the rapidity of travel . . . that a residence 10-20 miles from his place of business is conducive both to health and pleasure . . .[5]

The reason for the Old Colony extension is not entirely clear since the southeastern coastal communities were already engaged in active water commerce with Boston. Although shoe and iron manufacturers situated south of Boston did give some promise of potential traffic, the ultimate location of the route near the coast actually bypassed important shoe centers located further inland.[6] The route accelerated the expansion of the inner suburbs of South Boston and Dorchester and further out enhanced the development of the industrial satellite of Quincy and the suburbs of Braintree and Weymouth.

Fitchburg and the towns northwest of Boston, dissatisfied with service from branch lines, wanted a direct connection with Boston. With the prospect of a Hoosac tunnel in northwestern Massachusetts these towns were convinced that they were located on a direct line approach from Boston to the tunnel connecting with the "west." Important raw materials — granite, minerals and timber — which abounded around Fitchburg could supplement depleted supplies in other areas and find a ready market in Boston. The completion of the Fitchburg line paved the way for the growth of the inner suburbs of North Cambridge and Belmont and the development of the textile manufacturing satellite of Waltham.

A direct rail connection from Boston to Lawrence was achieved in 1848, the only earlier connection being a branch of the Lowell line. Lawrence, like Lowell, was fast developing as a textile center. Through a policy of low fares, this railroad was successful in fostering dense suburban development in Malden and Melrose to the north. By 1855, the line had the highest passenger

3. *Ibid.*, p. 202.
4. *Ibid.*, pp. 111-117.
5. *Boston Almanac* (Boston: Thomas Groom, Inc., 1847), p. 160.
6. Kirkland, *op. cit.*, pp. 111-117.

volume of any railroad in New England and at times this volume was higher than any other railroad in the nation.[7]

Another railroad line was extended north along the coast from East Boston through Revere to the thriving industrial areas of Lynn and Salem. These cities were already well served by a turnpike and frequent coastal water sailing; the railroad could not effectively compete for freight and passenger traffic with other modes of transportation.

Two other rail extensions were made southwest of Boston, at first ostensibly to tap local traffic but actually to eventually provide a direct rail route to New York City. The Midland route, traveling jointly with the Old Colony route from South Station through South Boston branched off to the southwest, opening up west Dorchester and Hyde Park for a dense suburban settlement and at the same time facilitated clusters of development in the more distant and wealthier suburbs of Dedham and Norwood. The other southwest route was formed by a branch route through West Roxbury connecting at Needham with the Woonsocket rail line through Dover to Bellingham.

D. *Railroads and the Regional Context*

a. *Second Era of Railroad Construction*

During the second stage of railroad construction — from 1870-1900 — the regional influence of Boston extended over a larger area. Construction of new railroad lines and end-to-end consolidation of existing railroads beyond Boston's hinterland satellite cities implemented this policy. Boston was viewed as a competition to such port cities as New York, Philadelphia and Baltimore. Railroad management viewed Boston's satellite cities as "gateways" beyond which Boston's hinterland could extend to New York City, the West, northern New England and Canada.

b. *Connections with Other Regions*

Boston sought connections with New York City for several reasons: New York was the largest center of population in proximity to Boston and a large reciprocal traffic was developed and sustained as each city provided a market for the other's commodities. During this period the two leading seaports were competitors for marketing and distributing goods from the midwest. Second, as New York's dominance as the nation's commercial metropolis became well established, commercial transactions between the two cities were more frequent and New York became an increasingly important market for Boston's goods. Third, New York became a natural gateway for marketing Boston's products.

Three possible routes were exploited as through routes from Boston to New York City. One was a coastal route from Boston through southeastern Massachusetts, Providence and along the southern coast of Connecticut to New York City. This route, formerly part of the Old Colony and Boston and Providence systems is now the main line of the Providence Division of the New Haven rail system. A second route, the so-called direct "airline" route, ran southwest from Boston diagonally across central Connecticut via Hartford, to New Haven and then to New York City. Today this route exists as the Midland line of the New York, New Haven and Hartford railroad. The third route extended westward through Worcester and Springfield then south through New Haven to New York City. Today the portion of the route to the west is part of the Boston and Albany system while the remaining portion of the route to the south is part of the New Haven railroad system.

Early in the railroad building era Boston tried to establish a direct connection to the west independent of New York City but was confronted with several serious obstacles. First, Boston was physically more distant from the fast-developing west. Second, two ranges of hills between Boston and the Massachusetts-New York border made any such connections expensive and less efficient than comparable connections from other major port cities on the coast. Third, unlike Philadelphia, New York and Baltimore, any connection to the midwest from Boston had to cross into another state and any line from Boston to the west could be easily tapped by branch connections to New York City.

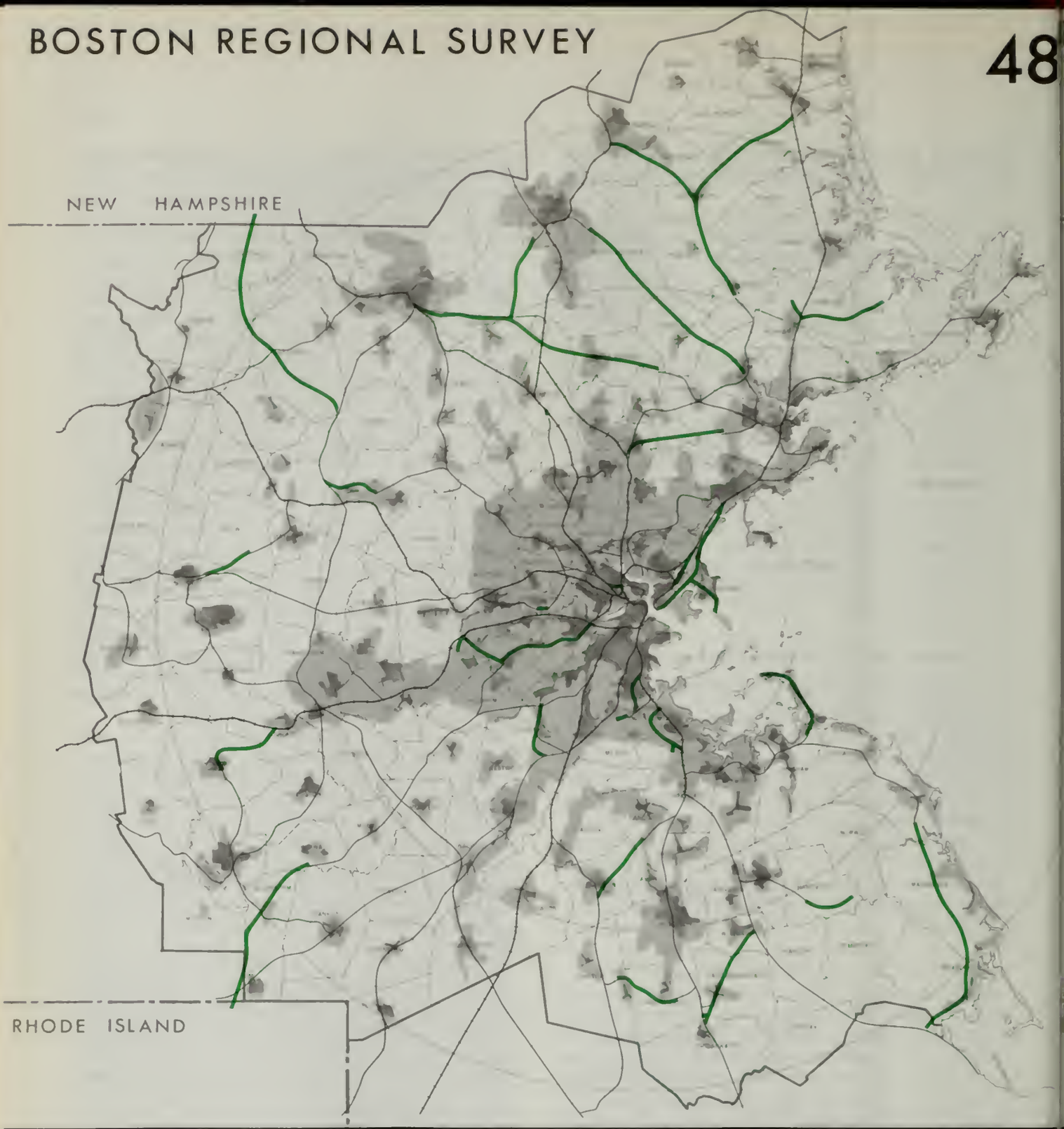
Two comparatively direct routes were used for connections from Boston to the west. One proceeded west from Boston through Worcester, Springfield, over the Berkshires to Pittsfield and Albany and is essentially the Boston and Albany railroad line as it exists today. Another proceeded up the Nashoba Valley northwest of Boston through Fitchburg, up the Deerfield River valley through the Hoosac Tunnel to New York State. The Fitchburg Division, as the route is currently called, is one of the most important lines in the Boston and Maine system.

Boston attempted to construct more indirect routes to the west with the secondary objective of tapping the northern New England and Canadian markets. But because these lines were longer and less efficient routes to the west, Boston could not compete with New York's Hudson River Valley route as a direct link to Canada. Further, Vermont and upstate New Hampshire did not develop substantial traffic potential.

The three indirect routes to the west are today a part of the Boston and Maine system and other connecting northern New England railroads. The first route extends from Boston to Fitchburg, through the eastern hills of Vermont, across the Green Mountains with connections north and west via the Champlain gateway. A second extends from Boston to Lowell up the Merrimack Valley to Concord, New Hampshire, then over the Green Mountains into the Champlain Valley with branches to Montreal and northern Lake Champlain. A third route extended from Boston to Concord and

7. *Ibid.*, p. 201

BOSTON REGIONAL SURVEY



RAILWAY TRACK, 1887 AND 1960

TRACK REMOVED SINCE 1887

TRACK EXISTING, 1960

1885 URBAN DEVELOPMENT

1960 " "

SOURCE: USGS MAP 1887, RAILROAD TIMETABLES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

GENERAL INFORMATION

EXPRESSWAYS
UNDER CONSTRUCTION
PROPOSED

MAJOR HIGHWAYS

SECONDARY HIGHWAYS

MAJOR RAILROADS

SECONDARY RAILROADS

RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

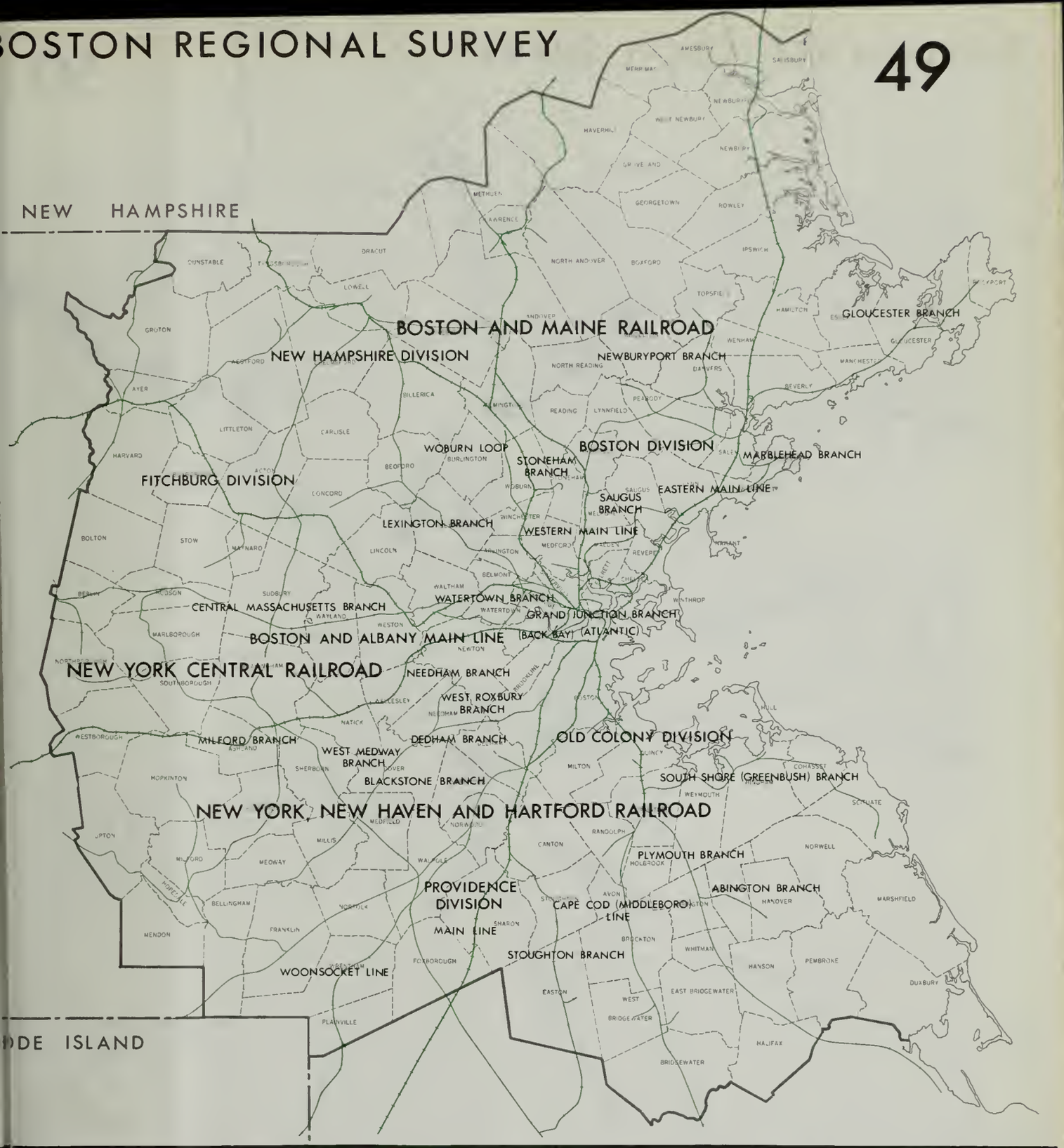
1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

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BOSTON REGIONAL SURVEY

49



RAILROAD COMPANIES AND OPERATING DIVISIONS, 1960

SOURCE: RAILROAD ROUTE MAPS AND TIMETABLES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 = 2560 ACRES

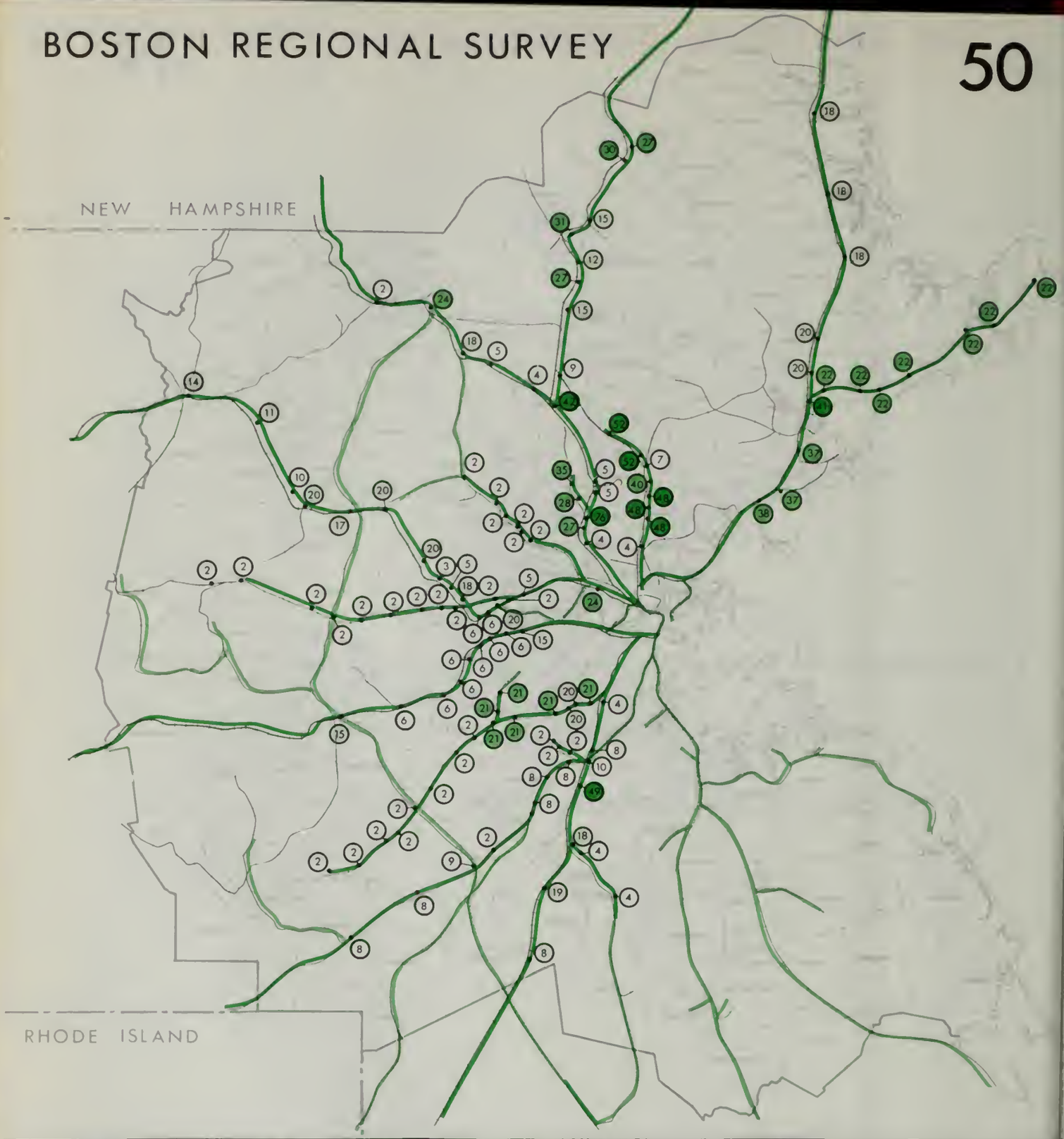
SQUARE MILES

0 5 10 MILES

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BOSTON REGIONAL SURVEY

50



TRACK CLASSIFICATION AND PASSENGER SERVICE, 1960

TRACK

- FREIGHT SERVICE ONLY
- PASSENGER AND FREIGHT SERVICE
- SERVICE DISCONTINUED

PASSENGER STATIONS

- UNDER 10 STOPS PER WEEK
- 11-20 STOPS PER WEEK
- 21-40 STOPS PER WEEK
- OVER 40 STOPS PER WEEK

SCOURCE: RAILWAY TIMETABLES

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 = 2560 ACRES SQUARE MILES

0 5 10 MIL

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BY THE PLANNING SERVICES GROUP, CONSULTANTS

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Plymouth, New Hampshire, Vermont, and then into northern Vermont to connect with Montreal and the west.

Maine and southern New Hampshire have traditionally been oriented toward Boston; their geographical location assured Boston commercial dominance. A direct route from Boston to Maine was constructed following the coastline north of Boston and extending through Salem, Newburyport and Portsmouth, New Hampshire, to Portland and Bangor. Today this comprises the main line of the Eastern Division of the Boston and Maine, although through service to Portland is maintained via another route.

The region's existing railroad network was largely constructed prior to 1850. From 1840 to 1880 there were numerous railroad consolidations as various companies sought to expand their service areas and obtain new through routes. By 1900 two large systems served the Boston region: the Boston and Maine and the New York, New Haven and Hartford railroad. Figure 48 shows the extent of the regional railroad network in 1887 and the changes that have since occurred. With the merger of this diffuse and complicated rail network into two systems, many lines, formerly important as main line routes of independent railroad companies, have become subordinate in function as the larger railroads chose the most efficient routing patterns from numerous available alternatives. In addition, branch lines that were formerly important competitive adjuncts to independent companies serving the region were viewed as unnecessary duplicating lines under consolidated ownership. During the first half of the twentieth century, the large railroad companies therefore adressed themselves to the task of reducing excess capacity and, as Figure 48 shows, since 1887 over 150 miles of track has been abandoned in the region.

2. RAILROADS IN THE BOSTON REGION

Three major railroads serve the Boston region. The Boston and Maine operates in the areas north, northwest and northeast of Boston and serves all of New Hampshire and Maine. The areas south, and southeast of Boston are served by the New York, New Haven and Hartford Railroad while the area west of Boston, between the New Haven and Boston and Maine railroads, is served by the Boston and Albany, a division of the New York Central Railroad.

A. *New York, New Haven and Hartford Railroad*

The New York, New Haven and Hartford Railroad system terminates at South Station in Dewey Square, Boston, via two main routes: one route travels to South Station via Back Bay and is primarily a passenger carrier; the other route travels along the coast and primarily carries freight Figure 50.

a. *Back Bay Route*

The Back Bay line leaves South Station in a westerly direction as far as Back Bay Station, travels in a southwesterly direction through Forest Hills and Hyde Park before connecting with a series of small branch lines and the main line of the New Haven's Providence Division. The Back Bay line proceeds south to Readville Junction where a short branch leaves the line to provide passenger service to East Dedham. The Back Bay route serves as the gateway to Boston for the New Haven's most important passenger and freight route to Providence and New York, and is more properly called the main line to Providence Division. From the Readville yards the main line to Providence proceeds south to connect with Providence and points beyond.

b. *Atlantic Route*

The Atlantic line as it leaves South Station splits almost immediately in South Boston. One line, once part of the Midland route to New York, is the main freight route in Boston proper. The other branch of the Atlantic system, the Old Colony Division, travels in a southeasterly direction along the Atlantic Coast toward Quincy and Braintree. At Braintree, the line splits into three branches. The South Shore branch or Greenbush line travels to the southeast along the coast to Scituate; the Plymouth branch proceeds to Plymouth; the Cape Code or Middleborough line connects to Cape Cod. The Old Colony system provided major commuter passenger service until 1960 when service was discontinued.

B. *Boston and Albany Railroad*

This system consists primarily of a single line running west from Boston through Back Bay crossing the state via Framingham, Worcester, Springfield, and Pittsfield to reach its terminus at Albany. One of the branches of the system, the Newton Circuit or Highland Branch, has been sold to the MTA. The Boston and Albany shares jointly with the New Haven railroad the passenger station facilities at South Station, but has its own yards along the Charles River in Brighton and in Framingham. The line provides through freight and passenger service from Boston to Worcester, Springfield, Pittsfield and Albany, New York and is thus a main line connecting the region with the west. The line also provides local commuter passenger service for the suburban communities directly west of Boston.

C. *Boston and Maine Railroad*

The Boston and Maine Railroad has three principal lines or divisions terminating at North Station on Cause-Street, Boston. The Boston and Maine maintains yards in East Somerville and at Greenfield in western Massachusetts.

a. *Fitchburg Division*

The main line of the Fitchburg Division runs northwest from Boston to connect with Fitchburg, Greenfield and North Adams before terminating at Troy, New York. This line is the most heavily used freight line entering Boston and offers local passenger service as far as Fitchburg.

b. *New Hampshire Division*

The New Hampshire Division provides passenger service from Boston via Lowell and the New Hampshire Merrimack River communities to White River Junction, Vermont. Since 1959, however, freight and passenger service via Lawrence to Portland, Maine has been routed to the New Hampshire Division via a short connection at Wilmington Junction. Thus, the New Hampshire Division is now the only line of the Boston and Maine system to provide through freight and passenger service along with local passenger service.

The New Hampshire Division has a complex system of branch lines. The main line runs northwest of Boston to Lowell. Three other lines branch directly from the main line. Passenger service was discontinued on the Stoneham branch in May, 1958. Another branch leaves the main line at Wilmington Junction and connects the Boston-Lawrence line with the New Hampshire Division's main line. This short spur connection has permitted through freight and passenger service from New Hampshire and Maine to be routed via the New Hampshire Division since 1959.

c. *The Eastern and Western Lines*

The Western main line, known as the Reading line, proceeds directly north from East Somerville to Reading. The portion of the line continuing northwest to connect with the line serving Lawrence and Haverhill was discontinued in June of 1959 and the Reading line now handles only freight and local commuter passenger service. In June 1959 service was also discontinued on the short Medford branch from Boston to the central portion of Medford and on the Newburyport branch between Wakefield running in a northeast direction to Peabody.

The Eastern main line proceeds from East Somerville across the Mystic River to Portsmouth, New Hampshire. The Eastern line provides both freight and passenger service, but since service terminates at Portsmouth, New Hampshire, only a short distance from the Massachusetts border, it can barely be considered as through service. The line serves Lynn and Beverly, two fairly sizeable cities only a short distance from Boston.

The Eastern main line has four branch lines, only one of which is still in operation. Service on the Saugus branch line between Everett and Lynn was discontinued in May, 1958, on the Salem to Marblehead branch in June, 1959, and on the Salem-Danvers line in May, 1958. The Gloucester branch leaves the main line in Beverly, and runs east to serve the Cape Ann areas as far as Rockport. This branch provides both light freight service and commuter passenger service.

3. TRENDS AND PROBLEMS

Although railroads provide service for both freight and passengers, freight operation is considered the function to which railroads are best adapted.

There are a number of problems in determining the relative profitably of respective railroad functions, primarily because railroad fixed plant is shared by freight and passenger service. Serious questions have been raised regarding the equity of the ICC method of allocating joint costs among different operational functions, and as a result statements about the revenue or deficit-producing characteristics of railroad freight or passenger service are frequently regarded with suspicion. The ICC system is especially questionable in allocating respective cost when railroads use the same trackage for long and short haul passenger service in addition to freight service.

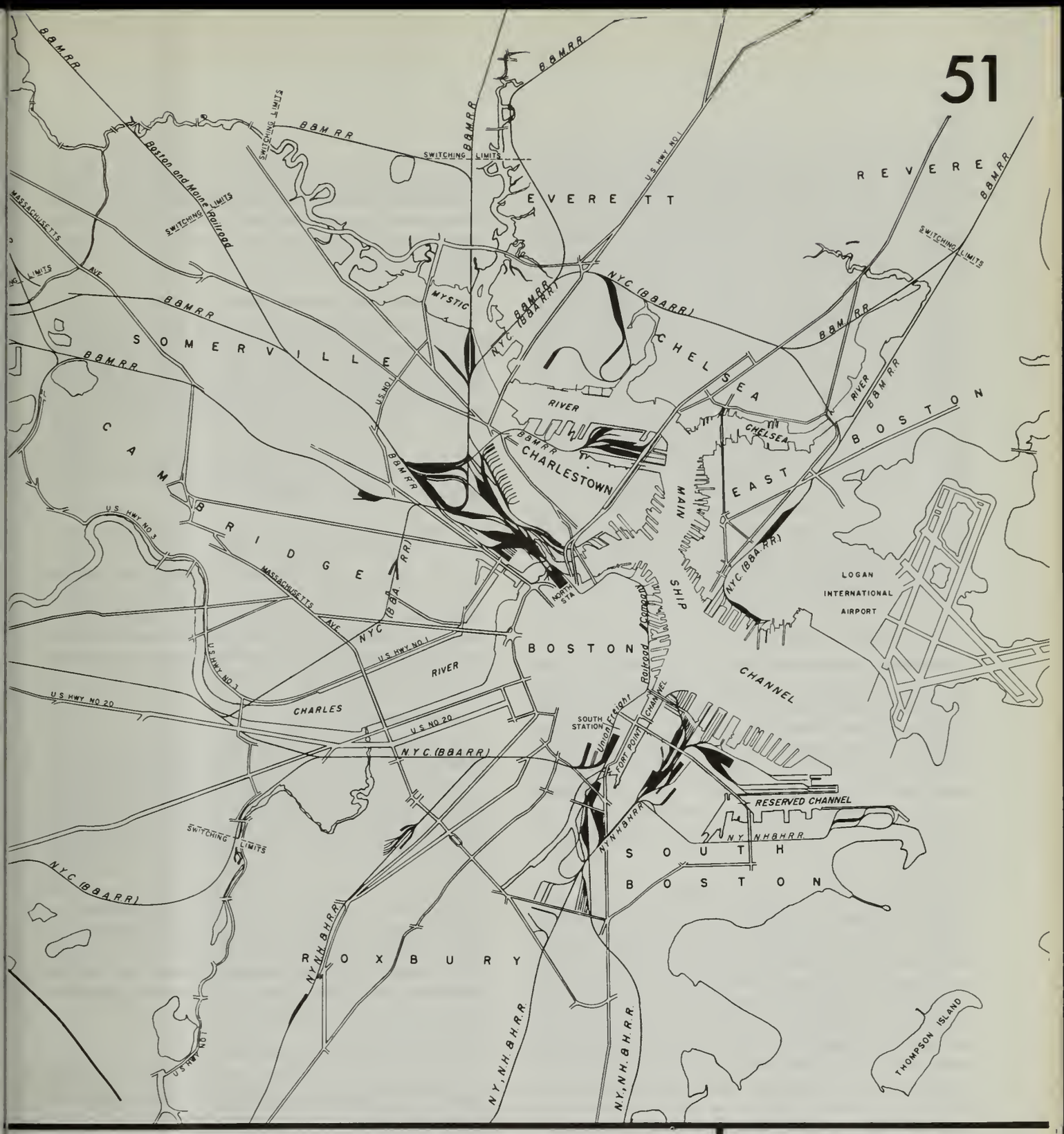
Another factor which intimately affects the economics of railroad operations is the institutional framework that governs railroad operations. The state and federal governments view railroads (like utilities) as necessary for the public welfare. Railroads are considered "common carriers" and as such their rates and level of service are regulated by government. There is a considerable gap between "institutional necessity" as defined by government from the point of view of public welfare, and "economic necessity" as defined by railroad corporations from the point of view of net return on operations. For example, railroad overcapacity is partly the result of geographic overextension of routes and branches which must be maintained to provide "necessary" minimum level of service. Government regulations hamper railroads from responding quickly to changing traffic trends and in revising levels of service and prices.

A. *The Effects of Technology on the Basic Competitive Position of Railroads*

The basic advantages of railroads are their large capacity, high speed and long-haul efficiency. However, the very factors that contribute to the effectiveness of railroads also contribute to the railroad's most serious disadvantage: inflexibility.

Inflexibility has both technological and economic aspects. Economies of large scale service are achieved through technological specialization. Because of its specialized character, the railroad right-of-way is not readily adaptable to other means of conveyance and customers must either cluster close to the system to obtain direct access or else use other means of transportation.

A combination of declining railroad traffic volumes and technological specialization has resulted in continuing high operating and maintenance costs. A large



RAILROAD NETWORK IN REGIONAL CENTER, 1960

B.&M.R.R. – BOSTON AND MAINE RAILROAD COMPANY
N.Y.C.(B.&A.R.R.) – NEW YORK CENTRAL (BOSTON AND ALBANY RAILROAD)
N.Y.N.H.&H.R.R. – NEW YORK, NEW HAVEN AND HARTFORD RAILROAD

SOURCE: U.S. ARMY CORPS OF ENGINEERS

NORTH

1/4 SQUARE MILE

0 1/2 1

MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION
BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING OF 1954, AS AMENDED

initial investment is required to provide a minimum operational plant which already has high built-in capacity and attendant high maintenance costs.· Thus, the level of investment, in contrast to other types of transportation, cannot be geared to the level of service desired. Approximately two-thirds of the investment in railroads is used to provide, maintain and operate fixed facilities such as roadways, tracks, yards, signals, repair shops and administrative offices. Operating and maintenance costs on these fixed facilities do not vary with changes in the amount of revenue-producing traffic carried by the system. Only 20% of railroad expenses are variable while 80% are fixed. However, it is important to note that the proportion of railroad expenses which are variable depends upon the time span over which these costs are viewed. For example, while a small proportion of costs may be variable daily or weekly, a larger proportion will be variable from year to year. With a heavy investment and high fixed charges, railroads have a rigid and often high break-even point, requiring a large volume of revenue-producing traffic before revenue will equal or exceed costs.

B. *Long-Range National Trends*

Inflation, cyclical business activity, changes in the structure of industry and industrial decentralization are long-term national trends that have influenced the decline in railroad business in favor of other competitive modes of transportation. Although most of these long-term trends have occurred independently, they have been abetted and accelerated by the inherent technological and economic weaknesses of the railroad in relation to the economies obtainable to other methods of transportation.

a. *Inflation and Business Cycles*

The long-term inflationary spiral following World War II has continued almost unabated, causing the price of railroad equipment, terminal costs, materials and wages to rise. Since these expenses represent a large share of the railroad cost structure, inflation has seriously under-cut earnings. Recent cyclical changes in business activitiy have also had their effects: The railroads have never fully recovered from a series of closely spaced, business recessions in 1948-9, 1953-4, and 1957-8.

b. *Industrial Composition*

The change in the composition of the nation's industries has more important implications in terms of long term demand for railroad transportation service. Industrial production has become more complex and there has been a corresponding increase in the number of industries producing relatively unstandardized, less bulky and smaller intermediate products. Many national growth industries, especially plastics, electronics and ordnance, reflect the trend toward compact, lighter materials and products with a high value. Other growth industries such as petro-chemicals rely on pipeline, barge or tanker shipments. Postwar industrial expansion has concentrated on manufactured products that are not as suited for railroad haulage as they are for truck, pipeline or other transport.

c. *Industrial Decentralization*

Transportation charges have risen more rapidly than other business costs during the last 10 years.[8] This trend has had a definite effect of the location of industrial plants. Single large plants serving national markets have gradually become obsolete as industries have decentralized to multiple plants serving sectional or regional markets. The smaller regional market with its characteristically shorter hauls is often more efficiently served by highways than by railroads.

C. *Long-Range Regional Trends*

New England and the Boston region have reflected national trends in regard to inflation and business cycles except for slight differences in timing and intensity. However, the effects of these trends on railroads have had particular impact on the Boston region because of characteristics peculiar to the area.

a. *Economic Growth*

Economic stability, slow population growth, plus great increases in the use of private transportation have resulted in an economic squeeze on railroads serving the Boston region.[9] Although other regions have had comparable increases in private transportation they do not show the decline in rail service experienced by New England. One reason for this regional decline is that New England has not been growing as fast as the nation. The national index of industrial productivity increased by almost 10% for 1955 to 1959, but in those years the New England index increased only 4%.[10] Although the Boston region has done somewhat better than the six-state area, the railroads serving the Boston region have been affected by area-wide trends.

b. *Industrial Decentralization*

The full impact of industrial decentralization has not been felt in the Boston region. The region is geographically isolated from the central portion of the national market and is at the northern terminus of the huge eastern "megapolis" market. Many plants manufacturing heavy goods serving a large sectional market of this type prefer to locate in the most dense center of the urban belt in maximize economies of distribution.

8. Benjamin, Chinitz, "The Effect of Transportation Forms on Regional Economic Growth," *Traffic Quarterly* (April, 1960), pp. 134-136.
9. *National Transportation Policy:* Preliminary Draft of a Report Prepared for the Committee on Interstate and Foreign Commerce, United States Senate, by the Special Study Group on Transportation Policies in the United States (Washington, D.C., January 3, 1961), p. 353.
10. *Loc. cit.*

c. *Automotive Competition*

The competitive inroads made by highway transportation on railway business have been particularly intense in the Boston area. The Boston region was an early leader in the development of limited-access intercity highways and now has an extensive network of expressways compared to other regions.[11] In the early 1950's Boston constructed the nation's first major limited-access highway (Route 128) around the fringes of the core, providing local impetus for decentralization of industry. A 1957 survey of three quarters of the companies located on Route 128 indicated that only a small number of firms representing about 5% of the total employment considered freight rail sidings important to their operations.[12]

Since 1945, new patterns of industrial concentration have been established along other major exressways. Most of the industries which have located along expressways are strongly oriented toward truck as opposed to rail freight. For example, many industries along Route 128 are accessible only by automobile.

d. *Industrial Composition*

The Boston region has come to specialize in light industries with unstandardized, high value products, such as electronics equipment, plastics and final stages of metal fabrication. Firms manufacturing these products are most apt to take advantage of the economies inherent in highway transportation. The slower growing paper and paper products, food and cement industries have traditionally been the principal customers of the Boston area railroads. Also, Boston railroads have lost much bulk coal traffic because of the increasing use of petroleum and natural gas for heating New England homes.

e. *Terminal Charges*

Because of the Boston region's dense pattern of urban settlement, its geographical position in relation to the national market and its historical difficulties in obtaining a through route, railroads serving the Boston region are saddled with particularly high terminal costs compared to other railroads in the nation. In this regard, distinction should be made among three basic types of railroad traffic: through, local and terminal. *Through traffic* on main rail lines over relatively long distances between major urban areas re-distributed over local branch lines in large urban areas becomes *terminating traffic* when it reaches its final destination. Both local and terminal traffic have a large proportion of expensive terminal operations such as switching, classification and assembly. Because the Boston region is made up of many densely populated metropolitan areas, cities and towns, much of the railroad traffic in the region is comprised of expensive local and terminal traffic. The New Haven's share of local and terminal traffic is larger than the Boston and Maine's share, because the New Haven serves the densely populated areas south and southwest of Boston. The Boston and Maine serves less densely settled areas north and northwest of Boston and connects with other railroad systems originating in northern New England.

Since the Boston region is a manufacturing center and produces little food or raw materials, large quantities of goods must be imported for processing by manufacturing plants and to provide for local consumption. Two factors, local consumption and the conversion of large, bulky shipments of raw materials into manufactured products of smaller size and weight, result in high proportions of terminal traffic and an unbalanced movement of traffic. More goods move into the region than out of the region and a considerable portion of the region's freight cars are hauled out of the region empty.

One indication of the delay and expense associated with the terminal function of the region's railroads is the large burden of per diem freight charges on the Boston area railroads. Railroad freight cars are consolidated into trains in order to make through connections to areas outside the originating railroad's jurisdiction. Reciprocal per diem charges are paid by each railroad for the use of another railroad's freight cars. Once their freight has been discharged, freight cars go to terminal yards for further dispatching and assembly and the railroad owning the terminal facility must pay per diem charges for delays or stopovers at terminal facilities.

f. *Length of Haul*

The short-haul nature of the region's railroads reflects the large proportion of local and terminal traffic and is a product of the pattern of dense urbanization and overlapping metropolitan areas. The Boston region's present railroad network is therefore a diffuse system of main lines and short branch routes and the main lines of New Haven and Boston and Maine railroads are no more than 250 miles in length. Short hauls make profitable operation difficult for the railroad companies, necessitating higher rates and therefore encouraging the diversion of both passenger and local freight traffic to private and common carrier highway transportation.[13] For example, the number of tons of local freight as well as its percentage share of total traffic has declined sharply since 1929 due to the effectiveness of truck competition for short haul local traffic.[14] Short hauls result in high terminal costs and operation at less than maximum efficiency[15] for the region's railroads.

11. *Loc. cit.*
12. Alexander Bone, *Economic Impact Study of Massachusetts Route* 128 Department of Civil and Sanitary Engineering (Massachusetts Institute of Technology, December 1958), p. 32.
13. New England Governor's Conference on Transportation, "A Railroad Policy for New England", *Public Transportation for New England,* Interim Report No. 7 (March, 1957), p. 21.
14. *Loc. cit.*
15. Even though the volume of traffic may be high, the average length of haul may be short resulting in frequent stops and large fuel and running time losses.

TABLE 58

AVERAGE LENGTH OF HAUL, FREIGHT AND PASSENGERS, BOSTON, NEW ENGLAND, EASTERN DISTRICT AND THE NATION, 1929-1959.

	1929 Miles per		1959 Miles per	
	Revenue Ton	Revenue Passenger	Revenue Ton	Revenue Passenger
Boston and Maine	125.84	21.36	173.64	23.68
New Haven	129.23	30.55	151.90	41.86
New England Region	114.28	28.51	142.84	39.26
Eastern District[1]	151.15	30.43	188.97	40.32
United States	182.46	39.81	250.91	65.23

1. The Eastern District includes all railroads east of the Mississippi River and north of the Virginia-North Carolina line.

Source: Interstate Commerce Commission, *Statistics of Railways in the United States, 1929*, and *Transport Statistics in the United States* (Bureau of Transport Economics and Statistics, 1960.)

Although the average hauls of the Boston and Maine and the New Haven for both passenger and freight are substantially longer than the average for New England, the average hauls for railroads serving Boston and New England are shorter than the average in either the eastern part of the nation or the nation as a whole. The discrepancy between Boston railroads and other districts in length of haul is generally greater for freight than passenger service. There are, however, two exceptions to this general pattern and they both apply to passenger service. The average passenger trip on the New Haven is actually longer than the Eastern District average but still considerably shorter than the national average. In contrast, the average passenger trip on the Boston and Maine is shorter than all other comparable districts. The New Haven still retains some medium-haul interstate passenger service in addition to its commuter service while the Boston and Maine's interstate passenger service is quite small compared to its short-haul commuter service. Table 58 also shows that in line with trends on New England railroads and the nation, the average haul for both passenger and freight on Boston railroads is growing longer as unprofitable short hauls are eliminated.

g. *Track Pattern*

In the early days of railroad construction competition was particularly intense around Boston, leaving as a legacy the problem of excess capacity in numerous branches and roundabout, duplicating routes. The Boston and Maine estimates that at the most only 58% of existing trackage is justifiably maintained:

> 42% of the railroad produces only 2% of the freight business; that 58% of the railroad produces the other 98% of the freight business; and that 27% of the railroad lying between Mechanicville, New York and Boston, between Worcester and Lowell, Mass., and between Lowell, Massachusetts and Portland, Maine, produces 74% of the freight business.[16]

The diffuse track pattern is an even more serious problem with the New Haven railroad. The Interstate Commerce Commission found that one-third of New Haven road miles accounted for 80% of the gross freight revenue and that there were 1,200 miles of very light density line.[17] Almost 25% of the New Haven's freight lines produce less than 3% of its traffic.[18]

D. *Capital Expenditures on Plant and Equipment*

In making expenditures on plant and equipment the railroads attacked the problems of reducing overcapacity, increasing efficiency and improving comfort and convenience. Continuous capacity use and deferred maintenance of railroad facilities during the period of World War II necessitated heavy capital expenditures on plant and equipment in the late 1940's and early 1950's. In the last few years, however, a distinct decline in capital expenditure has become evident.

a. *Rolling Stock*

The railroad movable equipment or rolling stock is the portion of the plant that provides transportation service. Carloads from individual customers are consolidated into trains hauled by the locomotive. Economies are thus achieved by spreading the costs of tractive power over as many revenue-producing carloads as possible. The *total cost* of providing power for traction is the same whether the trainload is large or small. On the other hand, *the cost per carload* is significantly

16. *Annual Report of the Boston and Maine Railroad*, 1956, p. 19.
17. Interstate Commerce Commission. "Report on Passenger Fares, New York, New Haven and Hartford Railroad Co.," Docket No. 333332, reported November 21, 1960.
18. *Six Month Report of the Trustees of the New York, New Haven and Hartford Railroad Company* (March 5, 1961), p. 1.

TABLE 59

INVENTORY OF EQUIPMENT IN BOSTON AND OTHER METROPOLITAN AREAS, 1959

	Self-Propelled Equipment			Locomotive-Propelled Trains			Locomotive Units in Service			
	Electric Passenger Cars	Gas-Electric Cars	Diesel-Electric Cars	Single Level Passenger Coaches	Total Passenger Cars	Steam	Electric	Diesel-Electric	Talgo	Total Locomotive
New York	1566	—	8	1,071	2,654	—	24	203	—	227
Chicago	280	—	—	859	1,139	—	—	133	—	133
Philadelphia	454	4	7	230	695	—	3	52	—	55
BOSTON	—	—	144	294	438	—	—	38	10	48
Cleveland	—	—	—	5	5	—	—	2	—	2

Source: *Collapse of Commuter Service, A Survey of Mass Transportation in Five Selected Cities* (Washington, D. C., 1959), p. 19.

smaller for larger trains than for small trains, stressing the inherent economies of large volume for railroads. Operating costs rise very slowly in proportion to distance traveled, making railroads a most efficient carrier for long hauls. Any distance over 150 miles is considered a long haul. The high initial investment for locomotives is justified economically only if the locomotive is utilized for carrying large heavy loads commensurate with its great hauling power. Cars must be sufficiently large and sturdy to accommodate these loads without damage, but light enough to insure that locomotive capacity is used to haul revenue-paying loads rather than unproductive dead weight. The heavy initial investment in cars can be defrayed within a reasonable period only by capacity loads and continuous use. Idle standing time means that expensive rolling stock is either excess to the needs of the railroad or not being efficiently utilized.

b. *Locomotives*

Most of the railroads in the United States, including the three railroads serving the Boston region, have almost completely converted from steam to diesel-electric locomotives (see Table 59).

c. *Freight Equipment*

The joint use by all railroads of each other's freight cars has generally served to reduce the incentive for replacement of obsolete freight equipment. However, the number of new freight cars purchased has increased considerably in recent years in the Boston region and in the nation (see Table 60).

d. *Passenger Car Equipment*

There has been less expenditure for new passenger car equipment in both the Boston region and the nation. The total number of railroad passenger cars in use has declined considerably in the last few years. The new passenger cars which are in use, however, are lighter, more attractive and more comfortable to ride in. The Boston region has taken advantage of improved passenger car equipment in the form of the B & M's Budd cars. By 1956, the Boston and Maine owned 108 Budd cars for commuting purposes, the largest number owned by any single system in the nation. As early as 1952 the New Haven acquired 40 Budd cars and by 1954 had a fleet of 100 such commuter passenger cars. As of 1961, 24 of the Budd cars were in service in the Boston region.[19] (See Table 61).

e. *Fixed Plant*

The railroad fixed plant can be described in terms of two distinct component parts of the system: the *road* over which the vehicle moves and its *terminal facilities.* The railroad right-of-way in the Boston region can be conveniently discussed in terms of the road itself, its design standards and its track pattern.

19. Accounting Department, New York, New Haven and Hartford Railroad, November, 1961.

TABLE 60

EQUIPMENT INSTALLED AND RETIRED, BOSTON AND THE NATION, 1950-1959.

Type Equipment	Boston and Maine	New Haven	United States
Locomotives			
Installed	199	410	17,581
Retired	326	571	29,444
Gain or Loss	—127	—161	—12,063
Freight Cars			
Installed	5,244	3,014	528,284
Retired	4,440	3,675	621,249
Gain or Loss	+804	—661	—92,965
Passenger Cars			
Installed	433	570	3,380
Retired	1,378	822	13,796
Gain or Loss	—945	—252	—10,416

Source: Interstate Commerce Commission, *Statistics of Railways in the United States, 1950-1954* and *Transport Statistics in the United States* (Bureau of Transport Economics and Statistics), 1954-1960.

TABLE 61

SUBURBAN SERVICE EQUIPMENT ACQUISITION IN BOSTON AND OTHER METROPOLITAN AREAS, 1945-1960

Metropolitan Area	Multiple Unit Electric 1945-1954	Multiple Unit Electric 1955-1960	Multiple Unit Electric Total	Rail-Diesel Cars 1945-1954	Rail-Diesel Cars 1955-1960	Rail-Diesel Cars Total	Coaches 1945-1954	Coaches 1955-1960	Coaches Total	Total 1945-1954	Total 1955-1960	Grand Total
New York	330	44	374	8	9	17	16	80	96	354	133	487
Philadelphia	53	6	59	12	—	12	12	—	12	77	6	83
BOSTON	—	—	—	48	96	144	21	5	35	69	101	170
Pittsburgh-Washington	—	—	—	10	6	16	—	—	—	10	6	16
TOTAL	383	50	433	76	111	187	49	85	134	510	246	756

Source: *Exhibit of Eastern Railroad Problems,* Eastern Railroad Presidents' Conference, October, 1961, p. 128.

f. *Road Characteristics*

The railroad right-of-way is composed of the roadway subgrade, ballast, ties and the rail itself. Although most of the railroad rights-of-way today appear adequate for present and future loads, a considerable expense for maintenance is required to maintain the roadway in proper operational conditions. The subgrade must be continually ditched for proper drainage; the ballast or rock must be renewed constantly so that rails do not heave or buckle from contractions or expansions caused by extremes of temperature; especially treated wooden ties that help keep the track in line must be replaced from time to time; the rail itself bearing the constant friction of passing wheels must be maintained to meet the general requirement of girder stiffness. The joints between adjacent rails that allow for normal contraction and expansion are starting points of deterioration that require 25% of the time, effort and expense spent on the right-of-way. The difficulties of road maintenance are compounded because the roads are geographically diffused while railroad shops tend to be centralized. Furthermore, most maintenance on the road must be performed while the railroad is in operation.

g. *Road Design Characteristics and Improvements*

Like the rights-of-way of other types of transportation, the railroad encounters certain physical restrictions in regard to curves and grades. When curves or grades are unduly sharp, actual running time is reduced in comparison to the maximum speed attainable and the load carried must be limited. Whereas 1% grades and six degree radius of curvature limitations were common in early railroad construction, design standards of 5% grade and one degree minimum radius of curvature are now considered ideal for maximum efficiency. Bridges are often responsible for imposing weight limitations on the load that can be carried by railroad. Interference at grade with other rights-of-way, such as highways that cross the rail right-of-way, cause slow-downs that reduce running time. Such conflicts also constitute a safety hazard which contributes to expensive accident claims. Elimination of private and public grade crossings has decreased running time and reduced accident claims. Major projects of this type within the Boston region have been accomplished by the Massachusetts Department of Public Works at Boston and Maine crossings in Winchester.

h. *Track Patterns*

A track pattern of turnouts, crossovers, sidings, auxiliary or branch tracks and parallel main tracks has been evolved to meet the needs of geographically diffused customers and to provide capacity for high-density traffic. A double-track main line provides four times as much capacity as an equivalent single track line with only 80% increase in investment. The supporting communications and signal systems facilitate the distribution of traffic, maintaining proper headways within the confines of the required density and frequency of service. Due to recent traffic trends, some main and branch lines appear to be either under- or over-equipped to handle traffic. Circuitous, duplicating and unprofitable routes are the heritage of early railroad construction when numerous branches were built to either undercut or prevent competition with other railroads.

By 1959 there were 530.5 route miles of track in suburban passenger service in the Boston area.[20] Although the decline in railroad traffic has resulted in a general reduction in the total mileage of road (see Figure 48 and Table 62), Boston still has half the route mileage of New York and more track miles than Chicago, Philadelphia and Cleveland. (See Table 63). With the density of traffic declining on multitrack main lines, curtailment has occurred through the elimination of extra tracks. Whole branch lines upon which demand for service was sparse have been eliminated or abandoned. This reduction in trackage may reduce the

20. American Municipal Association, *The Collapse of Commuter Service — A Survey of Mass Transportation in Five Selected Cities* (Washington, D.C., 1959), p. 17.

TABLE 62

MILEAGE OF TRACK OWNED, LEASED AND OPERATED BY BOSTON RAILROADS, 1929-1959

	New Haven				Boston and Maine			
	1959	1929	Change 1929-59	%	1929	1959	Change 1929-59	%
Miles of Road	2,133	1,762	— 371	17.4	2,077	1,557	— 520	25.0
Miles of 2nd Main Track	836	447	— 389	46.5	611	497	— 114	18.6
Miles of all other Main Track	267	223	— 44	16.4	10	10	—	—
Miles of passing, way switching, and yard switching track	2,066	1,287	— 779	37.6	1,338	822	— 516	37.4
Total all track	5,302	3,719	—1,583	30.0%	4,036	2,886	—1,150	28.6%

Source: Interstate Commerce Commission, *Statistics of Railways in the United States, 1929,* and *Transport Statistics in the United States* (Bureau of Transport Economics and Statistics, 1960).

effectiveness of railroads as a competing mode of transportation by limiting the railroad's geographical scope of coverage. However, with the installation of a new, more efficient automatic communication and control system known as Centralized Traffic Control (CTC), reduction of duplicating miles of track on high-density main lines has occurred with an actual increase in traffic-handling capacity. The Boston and Maine has been particularly active in utilizing CTC.

TABLE 63

ROUTE MILEAGE OF SUBURBAN RAILROAD IN BOSTON AND OTHER METROPOLITAN AREAS, 1959

	Route Miles Operated			
	Single Track	Double Track	Three or More	Total Suburban Service
New York	349.8	542.6	278.9	1,171.3
BOSTON	273.2	207.8	49.5	530.5
Chicago	78.9	189.3	149.3	417.5
Philadelphia	130.0	241.1	24.3	395.5
Cleveland	—	119.0	—	119.0

Source: American Municipal Association, *Collapse of Commuter Service — A Survey of Mass Transportation In Five Selected Cities* (Washington, D. C., 1959).

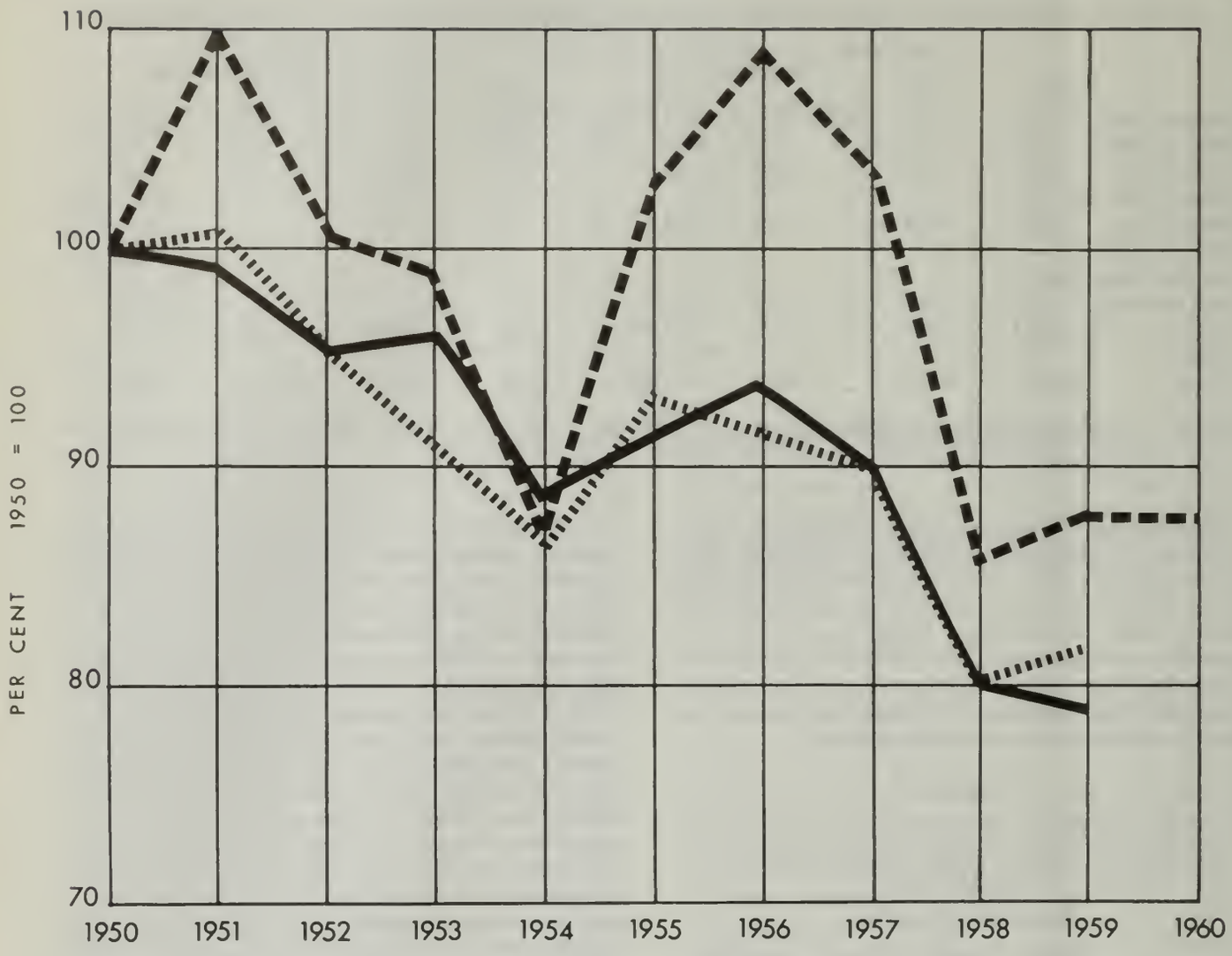
i. *Terminal Facilities*

Railroad terminal facilities transfer, discharge or assemble persons or commodities. Yards and terminals transform cars into trains. After cars are inspected for mechanical condition, they are classified and switched into groups according to destination and finally assembled and dispatched. Because of the physical design restrictions of the railroad right-of-way, these complex movements require considerable space for track. This series of operations is responsible for much of the idle time and delay of rolling stock and can easily nullify the improved running times obtained through technical improvements in other parts of the system. It has been estimated that approximately one-half of the money and two-thirds of time expended in moving freight from origin to destination is spent in this process. This operation, therefore, can seriously affect the railroad's competitive position with other forms of transportation in terms of convenience, time and service to the customer. Railroad terminal facilities can be broadly defined to include yards, large city passenger terminals and community way stations. With declining passenger traffic, many way stations and terminals in the Boston region are now redundant. The stations, often of grandiose design, are not efficient in handling passengers and baggage and consolidation of diffuse maintenance and repair yards into centralized locations has reduced the need for yard space.

By 1958, the Boston and Maine railroad had sold or contracted to sell 106 stations and thereby anticipated an annual reduction in costs of $235,000.[21] Its widespread use of Budd cars allowed the retirement of a passenger yard in Boston in 1957. The Boston and Maine has also consolidated repair and maintenance facilities at its yards located in Billerica. The New Haven has sold a number of stations and has abandoned its repair and maintenance facilities on the Boston-Dedham line in favor of consolidated shop operations near New York City. It has, however, established a new passenger station on Route 128 which offers easy highway access to the suburbs.

Because of the already built-up nature of many communities in the region and because of the blighting factor caused by smoke emanating from the old steam

21. *Annual Report of the Boston and Maine Railroad,* 1958.



FREIGHT REVENUE TON MILES PERCENTAGE CHANGE, 1950 - 1960

		1950 REVENUE TON MILES (MILLIONS)
▬▬▬	EASTERN DISTRICT	249.50
━━━	B. & M. R. R.	3.20
┈┈┈	N. Y., N. H. & H. R. R.	3.80

SOURCE: INTERSTATE COMMERCE COMMISSION, TRANSPORT STATISTICS IN THE UNITED STATES

locomotives, stations and yards were located near, but rarely in the center of, community business districts. These locations resulted in advantages and disadvantages for the railroads. Because of their location, ad valorem taxes were high, adding to operating costs and providing further incentive for abandonment and relocation. Also, these properties often have an excellent potential for real estate development. Thus, the combination of high taxes and good development potential have abetted the trend to abandon current station and yard holdings. Certain technological improvements have helped to make possible these changes. With improved centralized communication systems, railroads have used a system of "prior classification" where freight cars are classified and designated long before they reach their ultimate destination. This is accomplished outside the built-up central metropolitan area through the use of belt railroad lines that bypass the congestion existing in the center and avoid backhaul. Yards located in low-value rural or suburban locations on these belt routes could be used for the assembly and dispatching of freight cars and trains, thus allowing retirement of some intown yards and stations.

Abandoned station sites have, in some cases, been used as parking areas at the periphery of the business districts, as in Woburn and Salem. In other cases, these buildings and yards have been converted to light industrial uses, warehousing or other commercial uses. In Lawrence, a portion of the Boston and Maine yards have, for example, been used by wholesaling and warehousing concerns. The abandoned Readville yards of the New Haven line have been used by a national food concern as a distribution and warehousing center for the region.

The most spectacular development possibilities lie in the station and yards located in or near the central city of Boston where land is scarce and yard and terminal facilities are strategically located in the path of natural growth of the central business district and secondary centers. The $200 million Prudential complex of offices, hotel and convention center now under construction where formerly these were yards used by the Boston and Albany for passenger cars is a spectacular example of the real estate development potential of abandoned yards. Abandonment of the yards was made possible by the sharp decline in passenger traffic which allow consolidation of yard service in Allston.

There is a belt railroad arcing from Mansfield in the south via Framingham to Lowell, Fitchburg, and Concord, New Hampshire, connecting the New Haven, Boston and Albany, and Boston and Maine systems. Framingham is a key interchange on this belt system and is a growing automobile assembly and manufacturing center. The Boston and Albany has recently bought 18 acres of land in that town near its Milford Branch to be developed into marshalling yards.

A substantial portion of the Boston and Maine yard service is in Boston and Somerville. Although these yards, located near downtown, may have the advantage of reducing switching and terminal work for traffic in or near Boston, there is the possibility that some of the operations performed at the Boston yards could be shifted to other Boston and Maine yards located on the main freight line at Greenfield in western Massachusetts. The North Station terminal area already comprises a substantial investment in hotel, offices and assembly facilities. Further commercial development is possible, in this area particularly, if the Boston and Maine were to abandon commuter passenger services. The partial abandonment of the yards in back of the North Terminal area has resulted in the sale and development of approximately 60 acres of land in Boston, Somerville and Cambridge for industrial use. A dozen firms have taken options on the land for the purposes of constructing plant and warehousing facilities.

The New Haven railroad has long expressed a desire to dispose of the South Station terminal in Boston. Various proposals have been made for new uses at this strategic location: office center, parking garage, civic stadium and apartment complex. With legislative proposals to fill in Fort Point Channel and the extension of the Massachusetts Turnpike into the area now under construction, a substantial development potential may exist for the extensive yards back of South Station.

4. RAILROAD FREIGHT TRAFFIC IN THE BOSTON REGION

A. *General Trends*

Although railroads carry a greater volume of freight now than prior to World War II, their share of total market declined sharply. Other modes of transportation, notably trucks, ships, airlines and pipeline increased their share of freight traffic. The percentage of total intercity freight traffic carried by railroads declined from 75% in 1929 to about 67% in 1946 to an estimated 44% in 1960.[22] During the last ten years, the decline in freight traffic has been both relative and absolute and is the most important problem facing the railroads. The decline has been particularly acute on railroads serving the Eastern District, especially New England. Despite this decline, however, railroads still carry more than twice the ton-miles of any competing mode of transportation.[23]

As Figure 52 shows, Eastern District railroads increased the amount of revenue ton miles[24] carried by about 10% during the single year 1951. Volume declined sharply during the 1954 recession but rebounded to the 1951 level by 1956. This improvement was short-lived; freight volumes declined to a new low during the recession of 1958 and have not yet recovered. Freight traffic on eastern railroads in 1960 was still 12% below

22. Interstate Commerce Commission, *op. cit.*, *p.* 59.
23. *Loc. cit.*
24. Revenue ton-miles are the total number of revenue tons transported and the distance each ton is carried. The measure indicates the quantity and distance goods are moved and is a practical indicator of the volume of freight moved.

the 1950 level. Although the New Haven and Boston and Maine generally follow the same pattern as Eastern District railroads, they have not exhibited the same resiliency during the postwar periods of economic recovery. These two Boston railroads, whose trends are remarkably similar did not exceed their 1950 volume during the decade and with volume drifting downward, by 1960 the freight tonnage they carried was about 20% below the 1950 level.

A 1959 survey of the New England Freight market relates trends in freight traffic to the economy of the area and has been cited as being generally applicable to Boston railroads.[25] Except for anthracite coal and textiles, the economic activity of the customers who traditionally do business with railroads has increased by about 31% during the period. The railroads have not only failed to capture a share of expanding market, but have lost traffic to other competitors, chiefly motor carriers.

Aside from the general economic and technological factors already cited, other specific factors help to explain the decline in railroad freight activity. Customers are maintaining smaller inventories and are, as a result, placing greater emphasis on speed and dependability of delivery; small shipments tend to minimize the bulk rate advantage of railroads. Deterioration of service, such as excessive delay in classification yards, poor switching service, uncoordinated freight schedules and the practice of holding for tonnage, were also reported as reasons for erosion of rail freight traffic.

25. Arthur D. Little, Inc., *The New England Freight Market; A Preliminary Report to the New England Railroad Presidents Conference* (Part I, Cambridge, December 1959, p. 2.)

B. *Composition of Traffic*

The composition of freight traffic in 1954 on railroads serving New England was generally more diversified than railroads in the rest of the Eastern District. As Table 64 shows, the railroads serving the Boston region, like railroads in New England, carried a much larger proportion of miscellaneous manufactured goods and products of agriculture than other Eastern District railroads. The large share of manufactured goods reflects the importance of manufacturing in the Boston region and in New England as a whole. The importance of agricultural products stems largely from potatoes originating in Maine. Mineral products, chiefly coal, make up about 20% of the tonnage carried by Boston railroads. Although Boston railroads carry a larger proportion of mineral products than New England railroads as a whole, the share of this category of commodities is still substantially below other Eastern District railroads and total tonnage carried by Boston region railroads appears to be diminishing. The Boston region railroads' share of other groups of commodities, such as animals and products, forest products and forwarder traffic, is generally higher than other Eastern District railroads, in line with the diversified regional economic pattern.

The composition of freight traffic on individual railroads serving the Boston region is generally quite similar.

TABLE 64

FREIGHT COMPOSITION, BOSTON, NEW ENGLAND AND EASTERN DISTRICT, 1954

Commodity Group	New Haven	Boston and Maine	Boston and Albany	New England Region	Other roads in Eastern District
Products of Agriculture	9.80%	12.03%	5.65%	14.09%	6.49%
Animals and Products	3.39	3.87	4.62	2.84	1.20
Products of Mines	21.99	20.64	26.55	18.99	55.84
Products of Forests	4.61	6.18	3.41	7.97	2.41
Manufactures and Misc.	56.72	55.28	55.21	53.63	32.91
Forwarder Traffic	1.71	.43	2.28	.76	.59
Total Carload Traffic	98.22	98.43	97.72	98.28	99.44
LCL Freight	1.78	1.57	2.28	1.72	.56
Total All Freight	100.00%	100.00%	100.00%	100.00%	100.00%

Source: "A Railroad Policy for New England," in *Public Transportation For New England*, New England Governors' Committee on Public Transportation, Interim Report No. 7, p. 20.

The New Haven railroad's mix of freight commodities with a slightly higher percentage of manufacured products, products of mines, forwarder traffic and less-than-carload freight, reflects its highly urbanized and industrial territory much of which lies outside the Boston region. In terms of total tonnage, the New Haven's leading commodities were coal, cement, manufactured iron and steel. Other important products were animal and poultry feed, scrap iron and steel, potatoes, flour wheat and fresh meat.

The Boston and Maine, on the other hand, shows a higher percentage of agricultural, forest and animal products than the New Haven. This composition of freight reflects the direct connection between the Boston and Maine and the rural territory of northern New England, particularly Maine forests and potato farms. While animal and poultry feed has overtaken coal as the leading bulk commodity, potatoes are not far behind in importance. Cement and forest-based products such as lumber, wood-pulp and manufactured paper products are also leading commodities carried by the Boston and Maine.

The freight composition of the Boston and Albany railroad more nearly resembles the New Haven. The Boston and Albany railroad carries a higher percentage of mine products and less-than-carload freight than other Boston railroads, but a smaller percentage of agricultural and forest products, emphasizing the highly industrialized nature of its territory.

C. *Revenue and Costs*

The average revenue per ton mile reflects the type of railroad commodities carried and rates charged, as well as the cost of freight operation. Boston and New England railroads have a higher average revenue per ton mile than either the Eastern District or the nation. (See Table 65). Because of the general increase in freight rates since 1929, the average revenue per ton mile has increased substantially in all sections of the nations during the last thirty years. However, in spite of the fact that the percentage increase has generally been greater in the rest of the nation than in New England, the revenue per ton mile differential between Boston and New England railroads and railroads in the nation was wider in 1959 than in 1929. Relatively high per ton mile revenues on Boston and New England railroads can be partly explained by the fact that over half of the commodities carried are manufactured and miscellaneous products rather than low-value bulk commodities. However, high operating costs are an important reason for the high revenue per ton mile, as is the composition of freight.[26] The low density of freight traffic on Boston railroads results in high costs of freight operations because of overcapacity and consequent poor utilization of railroad locomotive power and fixed facilities. Short hauls and the related high terminal and switching costs, characteristics of Boston railroads, are significant factors in the high cost of freight operation.

TABLE 65

AVERAGE REVENUE PER TON MILE OF FREIGHT, BOSTON, NEW ENGLAND, EASTERN DISTRICT AND THE NATION, 1929 and 1959.

	Revenue Per Ton Mile (Cents)	
	1929	1959
Boston and Maine	1.73	2.16
New Haven	2.00	2.35
New England Region	1.78	2.35
Eastern District	1.05	1.59
United States	1.08	1.40

Source: Interstate Commerce Commission, *Statistics of Railways in the United States, 1929* and *Transport Statistics in the United States* (Bureau of Transport Economics and Statistics, 1960).

D. *Summary — Revenue and Tonnage*

A few significant trends in both the *revenue* and *tonnage* of freight carried by New England railroads from 1950 to 1957 are applicable to Boston railroads.[27]

1. About 45% of the total tonnage lost by New England railroads was represented by products of mines, chiefly coal. The shift of consumer markets from coal to petroleum and natural gas which are shipped via pipeline and water is responsible for this trend.
2. Manufactured and miscellaneous products accounted for a 14% increase in revenue, but total tonnage actually declined slightly. This group of products accounted for over 60% of total New England rail revenues despite the fact that much of the volume in this category now moves by truck.
3. Revenues from products of agriculture increased 13%, despite a significant decline of 8% in tonnage.
4. Forwarder traffic increased in tonnage by about 18% while less-than-carload freight decreased sharply (60%). Most of this less-than-carload freight is now shipped by truck.

5. RAILROAD PASSENGER SERVICE IN THE BOSTON REGION

A substantial decline in railroad passenger volume has been one of the main problems plaguing eastern railroads during the last decade. The principal reason for railroad passenger losses has been the diversion of traffic to other modes of transportation. Automobiles now carry about 90% passenger traffic, and railroads, buses and airplanes compete for a share of the remaining 10% of the market.[28] Railroads accounted for about 13%

26. "A Railroad Policy for New England," *op. cit.*, p. 24.
27. Arthur D. Little, Part I, *op. cit.*, p. 6.
28. *Exhibit to Eastern Railroad Problems; The Serious Situation and Its Causes,* Eastern Railroad Presidents Conference (Jersey City, October 1961), p. 54.

of passenger traffic as recently as 1947, but only accounted for about 3% in 1960. In 1947, the railroads' share of the total passenger travel market was larger than that of airlines or of buses. By 1960, however, more passengers were carried by airlines.

Railroads began to lose passengers to the automobile in the middle 1920's By the 1930's railroads began to feel the effects of competition from buses. Passenger volume continued to erode until World War II when the railroads experienced a brief resurgence due to gasoline and tire rationing and increased military use. After the war the automobile increased its share of the market at an accelerated rate and the railroads also began to lose long distance inter-city passengers to the airlines.

A comparison of trends in revenue passenger miles[29] of railroads in the Eastern District with the two major railroads that serve the Boston region indicates that railroads in the area have shared in the passenger decline. (See Figure 53). Eastern District railroads showing steady decline, however, has not declined as sharply as most railroads in the eastern portion of the nation. In fact, passenger volume actually increased on the New Haven in the early 1950's, but this was followed by a steep decline in the second half of the decade. While passenger volume of railroads in the eastern United States declined over a third, New Haven volumes declined only about a fifth in the 1950-1959 period. Passenger volume trends for the New Haven railroad include a considerable amount of traffic in the New York metropolitan region.

Passenger volumes on the Boston and Maine have followed a far less favorable trend, declining by no less than 60% in the decade.

This gross comparison does not distinguish between interstate and local commuter passenger traffic which have declined at different rates, for different reasons and with different economic consequences. The railroads' passenger-carrying role has traditionally been considered by many railroad managements to be secondary to the more profitable freight-carrying function. Short haul or commuter passenger business is usually viewed as a deficit operation.

Railroad passenger service is divided into two distinct parts, based on differences in length of trip and economic function: *intercity passengers* are carried over moderate to long distance between major cities, and *commuter passengers* are carried from home to work over short distances within large metropolitan areas.

The pattern of railroad traffic relative to passenger and freight service and the composition of passenger traffic in regard to long distance and local commuter service can have important effects. Railroad service patterns in the Boston region differs markedly from railroads in other parts of the nation.

29. "Revenue passenger miles" are an effective measure of railroad passenger traffic volume. Passenger miles are the product of the number of passengers carried and the distance each travels.

TABLE 66

PER CENT OF FREIGHT OPERATING INCOME CONSUMED BY PASSENGER OPERATING DEFICIT[1]

	Total Cumulative Percentage 1954-1960
Reading	37.65
New York Central	50.80
Pennsylvania Railroad	53.77
Erie-Lackawanna	58.55
Boston and Maine	69.08
Central Railroad of New Jersey	75.48
New York, New Haven and Hartford	105.57

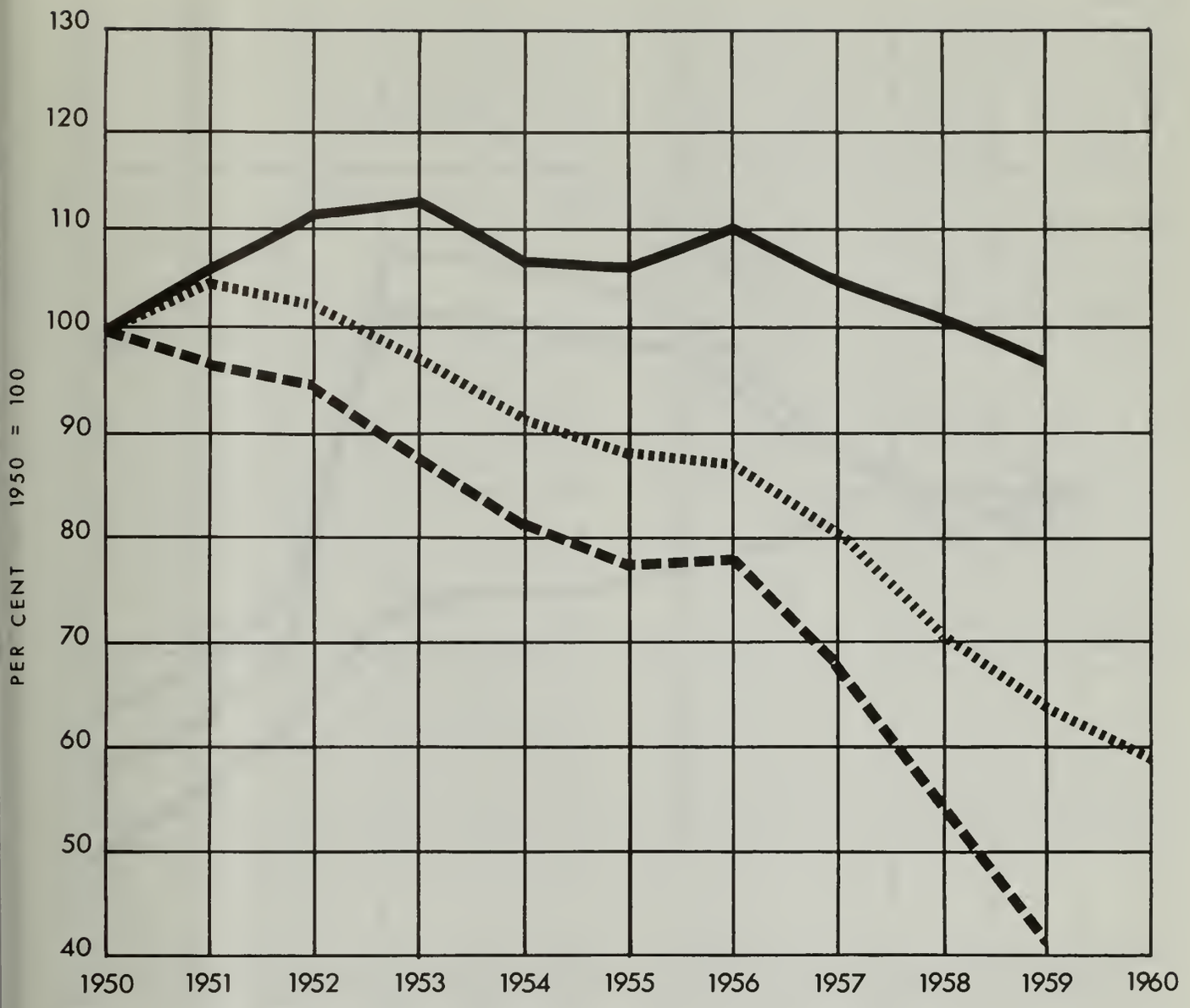
1. Net operating income and net operating deficit.

Source: *Exhibit to Eastern Railroad Problems*, Eastern Railroad Presidents' Conference, Jersey City, October 1961.

The percentage of total business devoted to passenger service has been especially high for railroads serving the Boston region. If passenger service is largely a deficit operation, as is often claimed, then this pattern obviously aggravates the earning problems of the region's railroads. Table 66 shows the percentage of freight income consumed by passenger deficits for major railroads serving the eastern part of the nation. It should be noted that the size of the passenger deficit as computed according to ICC formula is subject to debate because of difficulties in allocating joint costs. However, the table gives a good general indication of the impact of passenger service operations on railroad earnings. The New Haven Railroad cumulative passenger deficit from 1954 to 1960 comprised the largest percentage of freight railway operating income of all major railroads in the Eastern District. Indeed, so great was this deficit that it contributed heavily to an overall operating loss. The Boston and Maine was not far behind; it had the third highest cumulative passenger deficit percentage of the major eastern railroads.

There are several reasons for the high proportion of passenger business on railroads serving the Boston area. The New Haven railroad provides service between New York and Boston and competes with other modes of transportation for one of the highest volumes of intercity travel in the country.[30] With its terminals located within two major metropolitan areas, the New Haven railroad also has, apart from the Long Island railroad, proportionally more passenger traffic than any other railroad in the U.S.[31] Although passenger volume carried by the Boston and Maine is not comparable to the total volume carried by the New Haven, it now carries the largest number of commuters into Boston. The small number of long-distance passengers carried by the Bos-

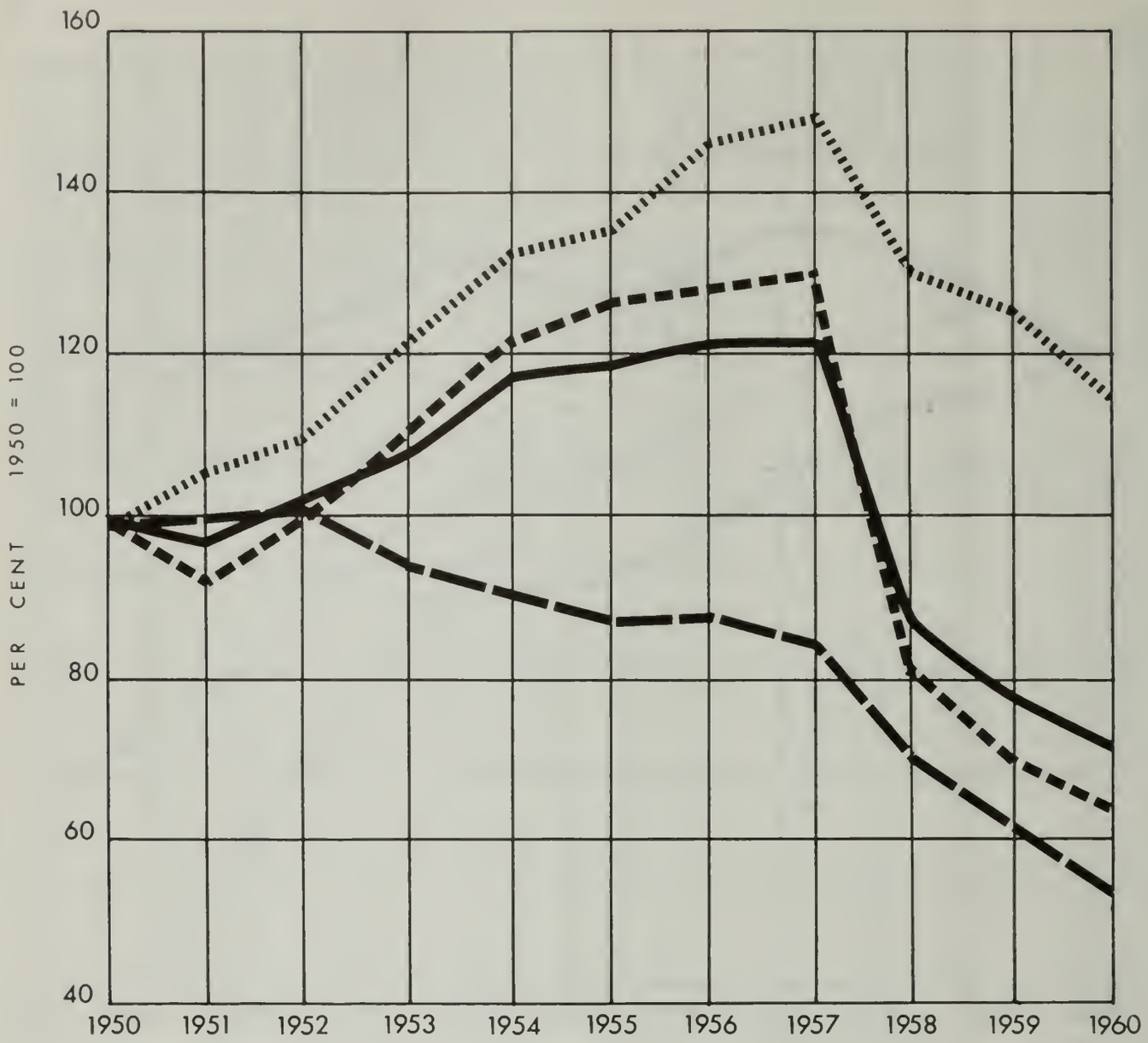
30. Jean Gottmann, *Megalopolis* (New York, The Twentieth Century Fund, 1961), pp. 639-644.
31. *Six Month Interim Report, New Haven Railroad, op. cit.*, p. 1.



REVENUE PASSENGER MILES
PERCENTAGE CHANGE 1950 - 1960

		1950 PASSENGERS (BILLIONS)
▬▬▬▬	EASTERN DISTRICT	15.90
▪▪▪▪▪▪▪▪▪▪▪▪	B. & M. R. R.	0.45
▬▬▬▬	N. Y., N H. & H. R. R.	1.80

SOURCE: INTERSTATE COMMERCE COMMISSION TRANSPORT STATISTICS IN THE UNITED STATES



NEW HAVEN RAILROAD PASSENGERS, BOSTON REGION, PER CENT CHANGE, 1950 – 1960

		1950 PASSENGERS (MILLIONS)
- - - -	15 MILES FROM BOSTON,	2.20
.....	BEYOND 15 MILE ZONE, INTRASTATE	0.73
— —	INTERSTATE	0.94
———	TOTAL	3.87

SOURCE: THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD, ACCOUNTING DEPT.

ton and Maine is a result of its geographical position, the scope of its operation and the characteristics of the territory it serves. As compared to the New Haven, the Boston and Maine is a medium-sized railroad serving only one major metropolitan area, Boston, and the less densely populated territory to the north and northwest. Its connections with other major cities are indirect and the demand for intercity travel in the territory served by the railroad is low.

A. *Long Distance Intercity Travel*

The Boston region is located at the northern end of the eastern megalopolis. Metropolitan areas and smaller independent cities are so closely spaced in this area that development is virtually continuous and the density of urban population in this area is among the highest in the nation. Railroads serving the Boston region concentrate on short-haul intercity travel through or within the northern portion of this urban zone.

The railroads' share of short-haul intercity travel in the region has declined considerably because of inroads made by competing modes of transportation. Railroads have lost passengers bound for medium to long range destinations to airlines, and to private cars and intercity bus companies. While railroads provide stops only at stations, automobiles and buses make more frequent stops and (in the case of cars or taxis) provide door-to-door service. On the favorable side, some people find railroad travel more relaxing than travel by air or automobile.

Railroad intercity passenger service to points outside the Boston region has been reduced considerably over the years. Reductions in service, in response to decline in demand, have induced even further declines in patronage.

In mid-1962[32] the New Haven railroad, the chief intercity rail carrier for the region, operated 14 trains per weekday from Boston to New York City, five of which are through trains to Philadelphia, Baltimore and Washington over Pennsylvania Railroad Company tracks beyond New York. There are 22 train runs on an average weekday from Boston to Providence; eight of these are commuter trains that provide extensive local service within the region. The Boston and Maine runs only three trains per weekday over its route to Portland, Maine; two of these trains go all the way to Portland, while one goes only as far as Dover, New Hampshire — all provide service to the Lawrence-Haverhill metropolitan area. The Boston and Maine operates six trains per weekday to Portsmouth, New Hampshire, just beyond the borders of the region, and five trains to Concord, New Hampshire, with one run extending to Laconia, New Hampshire and another run going as far as White River Junction, Vermont. Through connections can be made at the latter point to the north and the west over other systems. The Boston and Albany provides two trains per day to Albany, New York, which also serves Worcester, Springfield and Pittsfield. Two trains every weekday go only as far as Springfield.

The metropolitan areas of Providence (population 816,000), Worcester (population 323,000), Portland, Maine (population 121,000), and Springfield (population 479,000) are all significant generators of intercity travel, but they are all located within a 100-mile radius of Boston so that the speed, convenience and flexibility of automobiles operating on interstate expressways offer clear advantages over railroad travel. The longer (200-mile) rail passenger haul to New York is probably a little less vulnerable to automobile competition but more susceptible to intercity bus and airline competition. The technology of the railroad plant is such that it generally has cost advantages relative to other modes of transportation for hauls over 150 miles. (In contrast, airlines have the highest line-haul cost[33]). This advantage holds true, however, only if railroads carry a high volume of passengers approaching their large capacity.

Intercity traffic in the last decade on the New Haven railroad experienced a greater overall decline than local rail commuter traffic in the Boston region, (See Figure 54). Intercity rail passenger travel on the New Haven held steady during the first three years of the decade, declined slowly toward the middle of the period but accelerated its decline at the end of the decade. The total number of intercity passengers declined by almost a half from 1950 to 1959; in the same ten years, commuter travel inside the 15 mile zone from Boston declined by over a third and commuter travel beyond the 15 mile zone actually experienced a gain of 15%.

B. *Railroad Commuter Travel*

Only five major cities in the United States — Boston, New York, Chicago Philadelphia and San Francisco — are served by commuter railroads. Table 67 indicates the magnitude and complexity of service in major railroad commuting centers. Boston ranks fourth, well behind larger metropolitan regions in the number of commuter passengers. If the number of independent railroad companies and major radial lines serving the centers is taken as indication of the complexity of the various systems, then Boston ranks third behind New York and Chicago but ahead of Philadelphia. In addition, Boston's railroads rank second to New York and ahead of both Chicago and Philadelphia in total route miles of track in suburban service. (See Table 63.) Boston's large route mileage in the single track category, a gross indicator of the extent of branch lines, is responsible for this relationship. Numerous main lines and branch routes are a legacy from the nineteenth century when the economic prospects of the Boston region stimulated railroad over-expansion. For example, Boston has only

32. This was written prior to the implementation of the Mass Transportation Commission $5.4 million mass transportation demonstration program, which provided for an experimental substantial increase in service.

33. *National Transportation Policy, op. cit.*, p. 313.

TABLE 67

SUBURBAN PASSENGER SERVICE: NUMBER OF COMPANIES, LINES, AND PEAK HOUR LOADS IN MAJOR COMMUTING CITIES, 1959

	Service		Total Number of Passengers			Weekday Peak Hour Percent of Total
	Companies	Lines (number)	Annual (000's)	Weekday Total	Weekday Peak Hour	
New York	7	7	184,020	322,850[1]	208,690	64.8
Chicago	4	6	68,931	206,135	79,325	38.2
Philadelphia	2	2	20,118	105,810	52,860	33.0
BOSTON	3	5	14,823	48,200	24,100	50.0

1. Excludes New York Central.

Source: Gunther M. Gottfield, *Rapid Transit Systems In Six Metropolitan Areas* (Government Printing Office, Washington, D. C., 1959); American Municipal Association, *The Collapse of Commuter Service* (Washington, D. C., 1959).

half as many commuters as Philadelphia but uses almost twice as many lines to handle this smaller volume. In most railroad commuting areas passengers are densely concentrated along a few major axis of travel; in Boston, railroad commuter lines spread out in a diffuse pattern along numerous travel corridors.

The 50% decline in Boston's rail commutation patronage from 1948 to 1959 is a little more severe than patronage declines occurring in other major railroad commuting centers during approximately the same period.[34] Only the Long Island railroad serving New York and the Northwestern and Milwaukee railroad lines serving Chicago showed increases during this period. In the New York area decreases ranged from 46% on the Lackawanna and 48% on the New York Central to 55% on the Erie. In Chicago, commuter traffic declined 47% on the Illinois Central and 25% on the Rock Island railroad. In the Boston region decreases in patronage have become more pronounced in recent years. Rail commuter patronage declined by over a third from 1948-1956 with the percentage decline almost doubling (60%) from 1956 to 1961.

The number of persons using railroads to travel to downtown Boston has declined at a faster rate than the number of persons using other modes of transportation for downtown travel. While travel to downtown by all modes of transportation declined by almost 30% between 1950 and 1959, railroads declined by about 36% and the MTA declined by 31%. However, a 28% gain in downtown travelers using the private automobile occurred in this period. The decline in the number of railroad commuters is apparently attributable to the decreasing importance of downtown as an employment center as well as to increased use of the private automobile.

34. *Ibid*, pp. 555-556.

TABLE 68

PERSON TRIPS TO DOWNTOWN BOSTON BY MODE OF TRANSPORTATION, 1950-1959

Mode of Transportation	1950 Number	1950 % of Total	1959 Number	1959 % of Total	Change Number	Change %
Railroad[1]	65,000	11.0	40,000[2]	7.0	—25,000	—38.5
MTA	245,000	41.0	170,000[2]	29.0	—75,000	—30.5
Automobile	290,000	48.0	370,000	64.0	+80,000	+27.5
Total	600,000	100.0	580,000	100.0	—20,000	—33.3

1. Includes relatively small number of commuters on independent bus lines.
2. 1959 Railroad and MTA passengers estimated by MTC planning consultant.

Sources: 1. Robert G. Davidson, *M.T.A. Rapid Transit Parking Program for the Metropolitan Transit Authority* (Boston, October, 1957).
2. Seminar Research Bureau, Boston College, Studies of Urban Transportation, *Travel in the Boston Region 1959-1960, An Evaluation of Transportation Needs* (Vol. III, April, 1961).

Table 69, showing the estimated number of weekday passengers on all Boston railroad commuter lines in 1948 and 1961, extends the 1949-1959 comparison to 1961 to take into account discontinuance of service on the Old Colony line and shows a regional decline in railroad passengers of 73%. The New Haven's share of the total commuter traffic, however, fell below 40% during the period, while the Boston and Maine's share advanced to over 50% with the Boston and Albany maintaining a stable share. Considering the New Haven's abandonment of passenger service on the Old Colony division in 1960, it appears surprising that the percentage decline in patronage was not greater. Passenger volume on the Old Colony fell from 25,000 in the year 1947 to 10,000 in 1957. Of the 28,500 passengers lost by the New Haven from 1947 to 1961, about 90% of this loss could be attributed to the gradual decline and eventual abandonment of Old Colony service. A number of New Haven commuter lines and branches did not experience nearly as great a decline as lines in other systems or regions as a whole, despite the complete loss of passengers on the Old Colony line. As noted earlier, the smaller declines occurring on several other commuter lines in the New Haven system is probably due to the 15% increase in patronage in the areas more than 15 miles from Boston.

In general, patronage declines were great on lines of the Boston and Maine system serving sectors northeast, north and northwest of Boston and on the Boston and Albany line serving the sector west of Boston than on lines in the New Haven system serving the sectors southeast and southwest of Boston. Two of the three most heavily patronized lines are the Boston and Maine's New Hampshire division and the New Haven's Providence main line which provide interstate through passenger service north and south of Boston. Non-commuter interstate passengers are probably responsible for the relatively high volumes on the New Haven. The Boston and Maine Reading line is the most important line providing commuter service only.

There are five major factors that appear to influence the amount of railroad commuting from various sectors of the region to downtown. First and foremost, is the extent of expressway construction in the various sectors. The move to suburbia has largely been auto-oriented and suburban expressway connections are often in direct competition with parallel rail lines. Secondly, the growing decentralization of industry and retail service activities oriented to the highways has diminished the overall importance of railroad commuting to downtown Boston. Third, the amount of new population growth and residential construction in various sectors is related to the

TABLE 69

ESTIMATED WEEKDAY PASSENGERS ON INDIVIDUAL RAILROAD LINES, 1948-1961

Railroad Lines	Number of Passengers 1948	1961	Decrease Number	Per Cent
Boston & Maine				
Eastern Line	11,300	2,600	8,700	77.0
Western (Reading) Line	10,200	3,400	6,800	66.5
New Hampshire Division	15,600	4,900[1]	10,700	68.9
Fitchburg Division	3,400	900	2,500	73.9
Total	40,600	11,800	28,800	70.9
Boston & Albany (N.Y.C.)[2]	7,300	2,300	5,000	68.9
New York, New Haven & Hartford				
Needham Branch	2100	1,700	400	19.0
Dedham Branch	4,200	1,500	2,700	64.2
Boston and Providence	3,800	3,400	400	10.5
Blackstone Branch	1,900	1,600	300	15.8
Stoughton Branch	300	600	+300[3]	+100.0
Old Colony	25,000	—	25,000	—
Total	37,300	8,800	28,000	76.0
Total Region	85,200	22,900	62,300	73.0

1. Includes Portland Division via Wilmington.
2. Years of comparison for Boston and Albany are 1953-1962.
3. Increase caused by private auto connection from areas where Old Colony service was discontinued.

Source: Mass Transportation Commission, *Demonstration Proposal,* April 5, 1962; Boston and Maine Accounting Department, *Monthly Passengers Handled In and Out of Boston.*

potential for railroad commuting, but the potential stimulus of growth on ridership levels is reduced somewhat by the first two factors. Fourth, railroads in the past were traditionally responsible for development of fashionable residential districts. Railroad travel retains something of a luxury flavor; out-of-pocket costs represented by railroad fare are probably higher than the out-of-pocket costs for automobile travel, and railroad cars are less crowded and more comfortable than MTA cars. Some areas of high average family incomes still exhibit a propensity to use railroad facilities. For example, Wellesley, the community with the highest percentage of high income families in the region, also has a relatively high percentage of railroad commuters. Fifth, and closely related to the previous factor, communities with large numbers of white collar workers who work in downtown services and financial enterprises seem to retain a strong affinity for railroad commuter service.

6. RAILROAD FINANCIAL TRENDS

A brief examination of long-term financial trends is essential for a proper analysis of the critical trends of the last ten years.

A. *Long-term Trends*

Long-term trends in railroad operating expenses and revenues follow an erratic pattern. Operating revenues and expenses of the nation's railroads declined drastically during the depression years of the thirties after having reached a peak in 1929. In the late 1930's both operating revenues and expenses began to rise, and after some acceleration during World War II reached a thirty year peak in 1947, two years after the end of the war. Thereafter trends drifted downward, although there have been peaks and troughs in the past years.

Although railroad operating revenues are somewhat higher than they were thirty years ago, increases have not kept pace with the nation's gains in gross national product. In view of the many freight rate increases since the war, the rise in operating revenues has been sluggish.[35] This limited rise in operating revenues is an indication of the railroad industry's failure to secure a proportional share of the fast-growing transportation market.

A key element in railroad financial structure is the relationship between operating expenses and operating revenues. Operating expenses as a percentage of operating revenues have been increasing for railroads in the nation, the Eastern District and Boston over the last thirty years. A general rise in the cost of equipment and materials added to higher labor costs has resulted in substantial increasese in operating expenses. As a result, the net operating income of the railroads has declined, leading to lower earnings for some, and to losses for others including the New Haven and the Boston and Maine.

35. "A Railroad Policy for New England," *op. cit.*, p. 36.

B. *Short-term Trends*

Figure 55 shows trends in operating revenues, expenses and net income during the last ten years for railroads in the Boston region and the Eastern District. Operating revenue and expenses for Boston and the Eastern District show a remarkably similar pattern. Both peak in 1952-1953 and again in 1956-1957, and both experienced a sharp decline during the recession of 1954 and an even more severe decline during the 1958 recession.

The railroad industry is extremely responsive to general economic conditions. Declines in business activity quickly induce declines in traffic which result in rapid decreases in operating expenses and revenue. The most recent railroad decline, starting in 1958, is particularly significant because of its lingering attitude; It has not been followed by recovery as characteristic of previous declines.

The railroads' financial picture is clouded by the fact that operating revenues are declining at a faster rate than operating expenses. Thus, operating expenses are absorbing an increasingly larger share of operating revenues. Although this pattern occurs both in the Eastern District and Boston, it appears to be especially serious with respect to Boston region railroads. Table 70 shows that, except for the New Haven, operating ratios have shown as great an increase in the last nine years as in the previous two decades. The increase in the New Haven's operating ratio has been greater than any other railroad or area listed. The serious implications of this pattern are even more apparent when trends in net income are examined. In both the Eastern District and Boston, net income has been declining in the last decade. The trend, however, is much more pronounced for railroads in the Boston region. The New Haven is actually in receivership and the Boston and Maine is in dire financial straits.

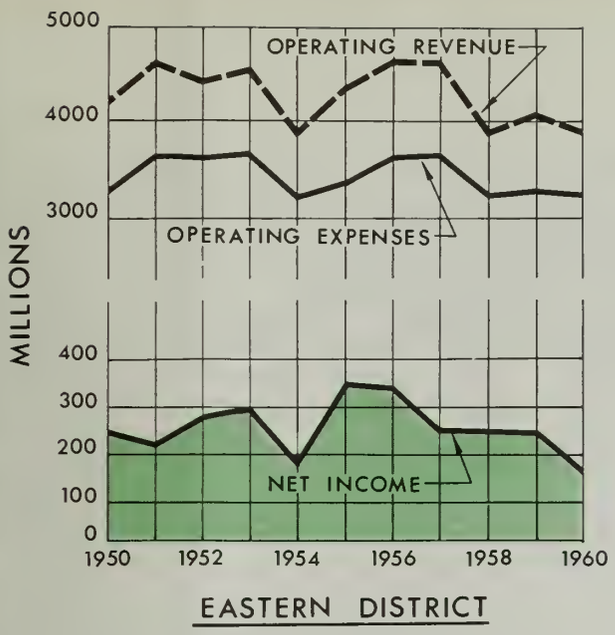
The Board of Directors of the New Haven, as debtors, filed a voluntary petition for reorganization on July 7, 1961, but the railroad at that time did not have sufficient earnings to be reorganized. It not only had a

TABLE 70

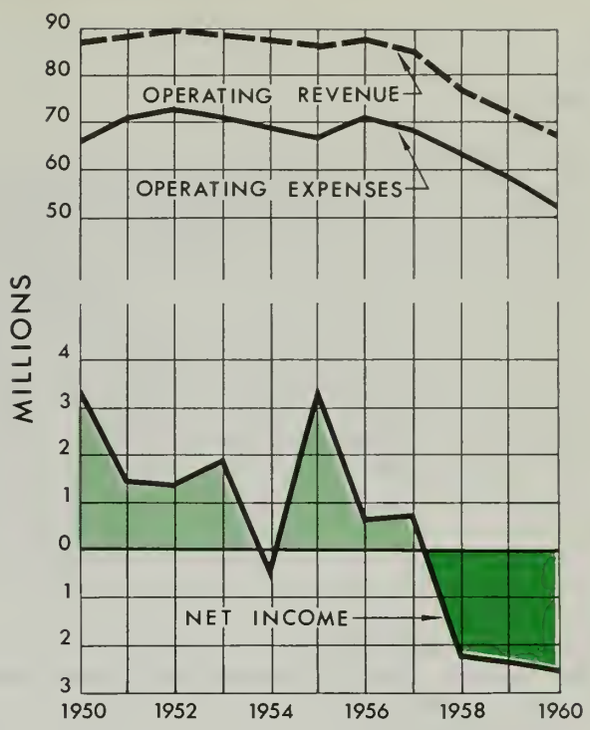
OPERATING RATIOS OF RAILROADS: BOSTON, EASTERN DISTRICT AND THE NATION, 1929, 1950, and 1959.

	1929	1950	1959
United States	71.8	74.5	79.5
Eastern District	—	79.4	83.5
Boston and Maine	75.7	77.7	79.2
New Haven	66.1	76.3	90.3

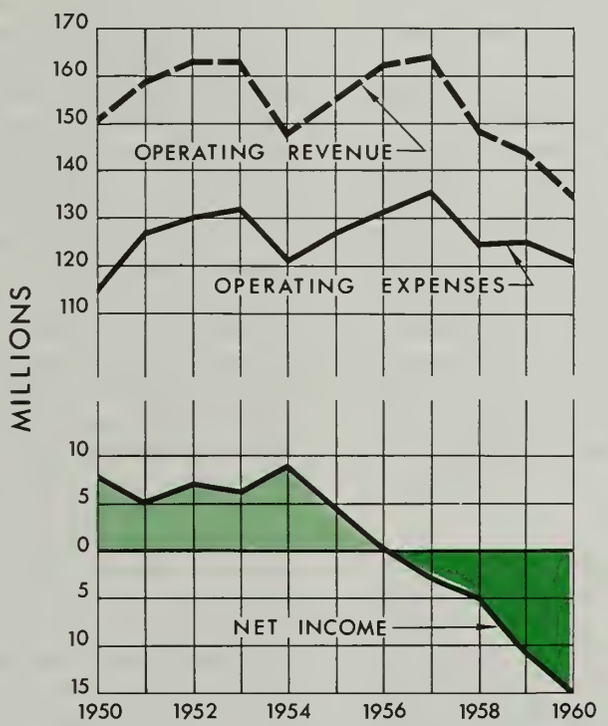
Source: Interstate Commerce Commission, *Statistics of Railways in the United States, 1929,* and *Transport statistics in the United States* (Bureau of Transport Economic and Statistics, 1960).



EASTERN DISTRICT



BOSTON & MAINE RAILROAD



NEW YORK, NEW HAVEN & HARTFORD RAILROAD

FISCAL TRENDS, EASTERN UNITED STATES
NEW HAVEN AND BOSTON & MAINE RAILROADS

SOURCE: ANNUAL REPORT AND YEARBOOK OF RAILROAD INFORMATION, 1961

TABLE 71

NUMBER OF EMPLOYEES AND AVERAGE WAGES, NATION EASTERN DISTRICT AND BOSTON, 1950-1959.

	Average Number of Employees Number			Average Compensation per Employee (Dollars) Number		
	1950	1959	Percent Change	1950	1959	Percent Change
United States	1,220,401	780,971	—56.0	3,765	6,266	+66.4
Eastern District	493,987	295,786	—40.1	3,814	6,297	+64.5
Boston and Maine	13,139	5,750	—56.2	3,596	6,153	+71.1
New Haven	21,402	11,670	—45.4	3,652	6,620	+81.2

Souree: Interstate Commeree Commission, *Statistics of Railways in the United States, 1929, and Transport Statistics in the United States* (Bureau of Transport Eeonomies and Statisties, 1960).

large operating deficit, but was spending more money than was being taken in, and thus had to borrow money to remain operational.

Under Chapter 77 of the Bankruptcy Act the United States District Court appointed three trustees, with the approval of the Interstate Commerce Commission, to run the railroad. The trustees must operate the railroad within the restrictions laid down by law, subject to the jurisdiction of the Interstate Commerce Commission and the control of the district judge.

If the New Haven manages to achieve an operating profit, the primary purpose of the trusteeship is the recapitalization and reorganization of the railroad. The trustees first had to stop the cash attrition (largely accomplished by the end of 1962) and then try to put the New Haven on a net earning basis before any plan for reorganization or recapitalization could be formulated and put into effect. Although revenues on the New Haven have doubled since 1935, they have failed to keep pace with rising costs. Maintenance of way and equipment costs have also doubled since 1935, but total labor costs have increased by 13% with the result that total operating costs have more than doubled.

C. *Operating Expenses*

Certain components of operating expenses have *declined* in recent years despite the general postwar inflationary rise in the cost of doing business. Trends in railroad operating expenses during the last nine years in particular, merit closer analysis. Railroad operating expenses may be divided according to various functions and in order of their importance in the total railroad cost structure: (1) providing transportation, (2) maintenance of way, structure and equipment, (3) general administrative and overhead expenses, (4) various miscellaneous expenses (diner service, for example), and (5) traffic.

Over half the total railroad operating expense is incurred directly in providing of transportation. Although the importance of this item has increased only slightly in Boston's railroads in the last decade, expenses directly associated with providing transportation service form a significant part of railroad operating expenses. Next in importance are the costs of maintaining way, structure and equipment. Maintenance cost comprised about 40% of total railroad operating expenses in 1950, but represented only about 30% of all costs in 1959. The decrease in importance of maintenance costs is an interesting development, since costs of maintaining fixed rail facilities must be borne regardless of fluctuations in railroad traffic. Part of the decline is probably due to abandonment and retrenchment of line and track, improved maintenance techniques and retirement of obsolete equipment. Not all the decline, however, can be attributed to reduction of facilities and better equipment. In the nine years that maintenance costs on Boston railroads declined, expenditures for maintenance increased substantially on Eastern District railroads. It is clear that some of the reduction in maintenance cost is probably due to deferred maintenance.[36]

Labor is one of the major cost elements in the railroad cost structure. While the average number of employees in the nation, Eastern District and Boston railroads was reduced from 40 to 50% between 1950 and 1959, labor costs have increased because the increase in average compensation per employee ran between 65 and 81%. (See Table 71.) Wage increases have thus tended to negate economies obtained from reduction in the railroad labor force.

In the past nine years wage increases for major Boston railroads have counterbalanced their substantial cutbacks in employment, reducing the effectiveness of one of the principal methods of halting rises in operating costs.

D. *Summary*

Long-term declines in railroad traffic have accelerated in recent years, resulting in a decline in net earnings for the nation's railroads and in net losses for the railroads in the Boston region. Declining net income or losses, in turn, have created a number of problems including:

36. "Railroad Policy for New England," *op. cit.*, p. 40.

a. *Delayed Replacement of Equipment and Undermaintenance*

With the advent of net losses, the outstanding effort of major railroads serving the Boston region in revitalizing their rolling stock and locomotives during the early 1950's has diminished in recent years and cannot be expected to revive. Undermaintenance of fixed facilities remains a continuing problem.

b. *Reduction in Service*

In Boston, as elsewhere in the nation, reduction of railroad service has been particularly evident in passenger operations. A recent survey also indicates that freight service has been cut back by New England railroads.[37] Over-capacity and underutilization of the railroad plant resulting from the decline in traffic and the consequent reduction of service has tended to diminish the ability to offset high operating costs through increased volume, and has led to deferred maintenance. Moreover, the gap between utilization and capacity has probably widened in recent years because of automation and technical improvements in equipment and communications.

c. *High Financing Costs*

The net losses of Boston railroads added to the physical deterioration of much of the railroad plant have placed the railroads in a poor position to obtain loans in the competitive money market. As a result, interest rates on loans have risen and the railroads' financing costs have generally increased.

7. PLANS AND PROPOSALS

A. *Basic Debilitating Factors*

Many of the basic causes of the decline of railroads apply to both the Boston region and the nation. It is useful to recapitulate them before considering proposed solutions. (1) Regulation of railroad common carriers has not taken cognizance of the fact that railroads no longer have a monopoly of transportation service. Examples of controversial restrictions often cited are: restriction on rate-making and passenger service abandonment; restrictions on combination with like or unlike modes of transportation in the interests of overall efficiency; and the "fair share policy" of rate regulation, or the practice of keeping the rates of one mode of transportation high in order to insure that another mode gets its "share" of traffic. (2) Technological improvements in other modes of transportation such as motor, water, air and pipeline make these carriers effective competitors for railroad business. (3) Changes in the structure of business in regard to inventory, location and type of goods produced have reduced the demand for rail freight shipment. (4) Vast public investment in highways, airways and waterways have reduced the costs incurred by carriers utilizing these facilities, penalizing the heavily taxed, capital-starved railroads. (5) There has been major growth in the use of private and contract motor carriers employing relatively lower paid workers. (6) Part of the decline in railroading is due, some critics feel, to overly conservative management.

37. Arthur D. Little, Inc., Part II, *op. cit.*

B. *Action by Railroad Management*

Railroad management has been criticized for emphasizing the production aspects of transportation at the expense of its distribution, sales and customer activities.[38] The railroads have not undertaken vigorous market research and promotion programs of the type common in other industries. Proper allocation of costs is another troublesome problem. Allocating costs to the various functions of the joint rail facility remains a matter of difficulty and dispute. Rail management would be more efficient if it were to develop a detailed and realistic distribution of costs for various types of traffic as well as by compiling adequate data on the character and location of past, present and future sales. Railroads have also been criticized for using train miles as a measure of cost and production efficiency.[39] Although the increasingly popular practice of using long trains may achieve lower costs from a production point of view, there is a point where this practice may have unfavorable effects on traffic volume by reducing scheduled customer service in a highly competitive market.

Confronted with declining traffic volumes, railroad management has generally taken four alternative courses of action to maintain net earnings:

a. *Increase the Volume of Business to Increase Revenues above the Break-even Point*

This approach to solving the railroad problem is the most general. It is also the most direct approach because it comes to grips with the basic technological and economic weaknesses of the railroads in relation to competing modes of transportation: their inflexibility compared to other modes in a changing, dynamic economy.

i. *Freight*

Containerization, a form of intermode combination, offers some promise for increasing the volume of railroad freight business. A specific railroad adaptation of containerization is piggyback, the movement of loaded or empty highway trailers on railroad flatcars.[40] The increasing popularity of piggyback service is cited as supporting evidence of the potentials of this type of service, while the railroad's inability to standardize rates and service is cited as a factor hindering its further development. Piggyback service combines the flexible, high grade service of the motor carrier with the long-haul cost advantages of the railroads, increases labor productivity and reduces terminal costs for all freight

38. *National Transportation Policy, op. cit.*, p. 292.
39. *Ibid.*, p. 299.
40. *Ibid.* p. 652.

and reduces handling costs for less-than-carload freight.[41] Since so much of the Boston railroads' business consists of terminal hauling, piggyback may have particular advantages in this region. In time, containerization on railroads may involve large scale rail movement of loaded trailers over main lines between distant points and abandonment of unprofitable or inefficient branch lines in favor of motor carrier service for pickup and delivery at main line terminals.[42]

ii. *Interstate Passenger Service*

Railroad intercity passenger service has been declining at a faster rate than shorthaul commuter rail passenger service.[43] Partly because of this trend, some experts advocate the discontinuance of all rail intercity passenger service. This may occur either by deliberate action on the part of railroad management or by a process of continued attrition. Proponents of abandonment claim that other modes of transportation — highways and airlines — are meeting most of the needs for interstate travel, that the railroads do not have any clear advantages in intercity service. An opposite point of view asserts that railroads do have a cost advantage for long-haul passenger movement and that major improvements in speed and frequency of intercity service would generate a sufficiently large demand to justify intercity rail service. In support of this argument, it is claimed that in recent years there has been a definite firmness in the medium-haul market (200 to 500 miles).[44]

The New York Regional Plan Association maintains that medium-haul rail passenger service would be particularly applicable along the densely populated urban northeastern seabord of "megalopolis." It advocates 200 mile per hour automated passenger trains on improved rights of way to divert unprofitable short-haul air passengers to railroads.[45,46]

iii. *Commuter Passenger Service*

Although fares for railroad commuter passenger service have been increased substantially in recent years, they are not sufficiently high to cover operating costs of the carriers. Railroad disadvantages in metropolitan mass transit are both technological and economic. Railroad costs are higher than other forms of urban mass transit and there is a high ratio of fixed to variable costs. Suburban railroad service does not offer either the long hauls or maximum utilization of plant necessary to reduce unit costs. While the typical length of a haul on suburban railroads is longer than in other forms of urban mass transit, it is not long enough to provide the opportunity for offsetting high fixed costs. Rail commuter service approaches capacity twenty hours of the week, but traffic declines to negligible proportions during the remaining hours of the week and the use of plant and employees is therefore relatively low.[47] Downtown rail passenger terminals are located away from major concentrations of employment and commuter railroads therefore do not have the flexibility or coverage of other forms of mass transit in the downtown area. Rail commuters who do not relish a ten to twenty minute walk from the rail terminal to their destination must transfer to another mode of transit at additional expense.

Despite these disadvantages, commuter traffic volume in the region and the nation actually increased in the mid-1950's. This increase was in contrast to the uninterrupted decline of longer haul interstate passenger service. In light of these trends, there have been several proposals for either improving service or retaining some form of rail transit for suburban and outlying areas of the region.

An attempt to increase passenger volume through improved rail commuter service in the Boston region was attempted earlier in the 1950's when both the Boston and Maine and New Haven railroads acquired new, more flexible Budd cars for passenger service. The resulting increase in the number of commuter passengers was not large enough to make commuter service profitable. This lack of substantial success may be partly because the innovations in Boston commuter service were not completely integrated: there was little simultaneous and systematic increase in frequency of service, and lack of effective cost accounting tended to obscure results.

Other cities with significant volumes of suburban railroad traffic have engaged in extensive service and equipment experiments. In 1958, Philadelphia initiated a rail subsidy program in which the city financially aided the Reading and Pennsylvania railroads in increasing commuter rail service. Since 1960, the Chicago and North Western Railway Company has engaged in a program of simultaneously improving equipment and service and increasing fares. Although the experiments in commuter passenger service and equipment in major cities do not appear encouraging, the results of the experiments have not been conclusive. The Mass Transportation Commission's recently approved demonstration program for increasing service and simultaneously reducing fares on certain Boston suburban railroads may help to clear up many unresolved questions about the future role of suburban commuter service.

There have been various suggestions for an integrated metropolitan railroad commuter system that would accommodate relatively long-distance metropolitan travel.[48,49] These proposals are based on the assumption that rapid transit is not suitable for long-distance extension and operates best with closely spaced stops serving dense urban areas. However, the type of suburban rail service

41. *Ibid*, p. 658.
42. John R. Meyer, "New England Transportation; A Fresh New Look at Our Old Railroads," *The New Englander* (August, 1962), pp. 14, 37.
43. *National Transportation Policy, op. cit.*, p. 322.
44. *Ibid.*, pp. 309, 312.
45. "200 MPH Railroad Line Proposed for Northeast," *New York Times*, July 30, 1962.
46. Meyer, *op. cit.*, p. 37.
47. *National Transportation Policy, op. cit.*, p. 559.
48. Stanley Berger, "How Communiters Can Have Their Trains," *Atlantic Monthly* (May, 1960).
49. James E. Lee, "The Old Colony Transportation Problem," *Traffic Quarterly* (July, 1961).

to be offered is a source of controversy. It is suggested that for high density traffic characteristic of metropolitan travel, electrified trains would be more efficient than diesel trains.[50] In this regard, a unified and electrified railroad transit system has been proposed to serve all of Boston's more distant suburbs (Hingham, Braintree, Canton, Needham, Framingham, Waltham, Lexington and Lynn). Such a plan would utilize a new direct rail connection between North and South Stations, eliminating the two stub-end terminals and providing greater coverage in the downtown area. Other proposals for non-electrified types of railroad service that would utilize Budd cars have been made for the Old Colony line and for a group of suburban communities west of Boston.[51,52]

b. *Increase the Unit Price of Transportation to Increase Revenues above the Break-even Point Thus Allowing for a Slightly Smaller Volume of Business*

This alternative has been attempted with generally negative results. Railroads are experiencing severe competition with unit prices charged for the same service by other modes of transportation. Increases in unit prices may reduce the volume of business to such an extent as to cancel out possible beneficial effects. A recent study showed that in Boston, for each 1% increase in commuter fares above 20%, the number of passengers carried decreases by 1 1/3% plus a factor of 1.6%.[53] The reverse policy of reducing prices in order to increase the volume of revenue producing traffic to a level above the break-even point has also had little success, although this type of action may be effective for selected products whose weight and bulk characteristics are such that there are clear economies in railroad use. It is hard to draw any definite conclusions regarding the effectiveness of selective increases and decrease of prices because government restrictions have never allowed the full free play of market forces to operate.

c. *Redesign the Railroad System Through Technological Improvements in Rolling Stock and Fixed Plant to Reduce Variable and Fixed Costs and Lower the Break-even Point*

Technological improvements have been responsible for declines in operating expenses during the past few years. Undoubtedly much more can and should be done, but two factors tend to limit the effectiveness of this alternative. The long-term inflationary rise in prices has increased the cost of labor, materials and equipment. Low earnings (and in the case of railroads serving the Boston region, net losses) leave insufficient funds with which to make the costly technoligical improvements. In fact, under these conditions the problem is actually aggravated by the tendency to defer maintenance. The economies of reducing trackage may limit the long-term competitive effectiveness of railroads if not accompanied by technological improvements that increase efficiency and capacity on existing lines.

d. *Discontinue the Product or Service*

This alternative has been advocated by railroads in regard to commuter passenger service. The underlying assumption is that any operation that consistently produces deficits should be discontinued and that substantial overall reductions in operating and fixed costs can be achieved by eliminating service and retiring the fixed plant associated with unprofitable operations. It is argued that such action will contribute to improved earnings by allowing profit-earning operations such as freight service to play a more signficant role in the railroad's total operation. Operations that produce consistent deficits are those which are best performed by competing modes of transportation.

Opponents argue that because of the importance of the shared fixed plant it is difficult to determine through the allocation of joint costs and profit or deficit characteristics of any of the manifold railroad operations. Even if an equitable method were developed, it is not the deficit operations that are important. The costs associated with a fixed plant of high capacity are both large and inflexible regardless of the amount and type of traffic. Therefore, any service that can provide revenues above costs will, by continuous utilization of the large potential capacity of the fixed plant, help defray the high fixed costs.

C. *Action by Government*

Municipal and state corrective action has been largely confined to the area of railroad commuter service. These remedies have included tax relief, direct cash payments, loans for renovation and re-equipping, and operation by public corporations or authorities, and mass transportation planning.

The Interstate Commerce Commission (ICC) regulates railroad fares and service and operates a loan guarantee program through federal taxation. However, the guaranty loan program (as provided for in the 1958 Transportation Act) has not been used by the railroads apparently because railroad management does not appear to be anxious to assume new debt and interest payments. It has been suggested instead that the ICC should implement a long term, low interest loan program and that cooperation be obtained from railroad management in adding new equipment instead of discontinuing service.[54] The only federal relief measure

50. *Ibid*, p. 473.
51. DeLeuw, Cather and Company, *Report to the Old Colony Area Transportation Commission on Plans for Improved Suburban Transit* (Brookline, April, 1959).
52. John S. Gallagher, *A Report on Rail Commutation Service between Boston and Western Suburbs* (Prepared for the Boston and Western Suburbs Transportation Council, Inc., February, 1961).
53. Seminar Research Bureau, Boston College, *Problems of the Railroads* (June, 1959), p. 30.
54. *National Transportation Policy, op. cit.*, p. 576.

that has actually been enacted is the reduction of the 10% federal excise tax on transportation, effective October 1, 1962.

D. *Mergers*

Merger means the unification of properties under a single corporate management, and operation and management as a single unit.[55] There have been two major assumptions underlying the argument in favor of railroad mergers. One is that mergers, by eliminating duplicating facilities and overlapping services and affording other economies, contribute significantly to a more efficient railway system. A second assumption is that a merger of railroads serving the same territory into a balanced railroad system, strengthens the financial position of the railroad system as a whole. It is claimed that merging the approximately 500 operating railroads of the United States into a relatively small number of systems would faciliate regulation, reduce costs, improve service capability and facilitate mobilization in event of war.

Opposition to mergers has developed at many levels: organized labor fears the loss of jobs; special interest groups in various communities fear that inequities might arise from reliance on one railroad carrier; some smaller railroads feel that they might be harmed by mergers.

A number of plans for consolidation on affecting railroads serving the Boston region have been proposed. Two alternative plans for consolidation have been widely discussed: (1) consolidation of Boston and other New England railroads into a single terminal system; (2) competitive combination of regional railroads with trunk lines serving the Midwest. Consolidation of all railroads serving the Boston region with a single large trunk system spanning the Eastern Disrtict is also a possibility.

a. *Northern New England Railroads*

The north-south lines that operate entirely in the three northern New England states (Maine Central, Bangor and Aroostook, Rutland) are not essential factors in these alternative consolidation plans. The northern railroads serve a raw material based territory rather than a manufacturing area and are originating railroads with relatively long hauls. Because of these characteristics, these railroads have traditionally been stronger financially than the railroads that operate primarily in the three southern New England states — Connecticut, Massachusetts and Rhode Island. If northern New England railroads were to merge with railroads serving the Boston area, the region's railroads would gain in strength, but this type of combination does not appear essential to the northern railroads.

The effect of mergers on northern New England railroads, however, is actually more complex than the above discussion appears to indicate. The Boston and Maine does not operate exclusively in southern New England. Its north-south lines extend into northern New England and are important to northern New England railroads as connectors to the Boston region.

For example, in 1954 more than half of the Maine Central's interchange traffic was with the Boston and Maine at Portland.[56] Thus, proposals for consolidation of the Boston and Maine, Maine Central, Bangor and Aroostook, and Rutland have been based on strong economic inter-relationships among the roads.

The northern New England roads also have an indirect interest in consolidation that occurs in the Boston region. The volume of freight traffic on the Boston Maine and New England railroads has been aided because these railroads use Canadian trunk lines that have a westbound rate differential advantage over American trunk lines serving the Middle West. Northern New England railroads fear that if the Boston and Maine and New Haven were to merge, the differential rates would be overruled by the ICC.[57] The New Haven makes little use of the Canadian differential routes and might benefit if traffic were diverted to American trunk line routes.

b. *New England Terminal Railroad*

One plan of consolidation advocates combining all three railroads serving the Boston region into one terminal railroad system. As explained previously, per diem charges on freight cars belonging to other systems are a significant expense item in the Boston railroad's budget. For example, the Boston and Maine is estimated to pay an average of $7 million annually in per diem charges.[58] Elimination of a substantial portion of these per diem charges might be achieved through consolidation into a single, merged, terminal railroad system.

Terminal or switching railroads in other parts of the nation, notably the Belt Railway Company of Chicago and the Terminal Railroad of St. Louis, are granted two days per diem charges free as a consequence of their terminal operation. However, unlike the proposed New England terminal railroad, these railroads are small, operating almost entirely within a single metropolitan area. The Terminal Railroad of St. Louis has only 400 miles of track and operates primarily in St. Louis and East St. Louis, connecting all lines that enter the city. The Belt Railway of Chicago is owned jointly by thirteen trunk line railroads and circles through a dense urban area only about seven miles from the center of Chicago. The main function of these two railroads is to switch cars among various trunk lines and customers. In both cases, the trunk line railroads absorb part of the per diem charges in return for the costly services provided by the terminal railroads.

55. *Ibid.* p. 229.

56. "Railroad Policy for New England," *op. cit.*, p. 32
57. *Ibid*, p. 54.
58. "Benson Calls New Haven Hostile to Merger Talks," *The Boston Globe*, July 30, 1962.

A New England terminal system, with Boston at the center, would apply for the same kind of per diem relief. Furthermore, by performing only switching or terminal operations for other railroads, the New England terminal system could reduce its ownership of freight cars and thereby reduce operating expenses associated with freight equipment. Per diem relief can be obtained only by approval of the Association of American Railroads, a national organization of interchanging freight railroads. Securing approval for a large terminal railroad covering all of southern New England may involve some problems. The consolidated terminal railroad would set a precedent by being the largest railroad to receive such relief and there is no assurance that other railroads in the association might not object to allowing per diem relief for such a large system.

In addition, the monopoly status of a consolidated terminal railroad presents further problems. It is claimed, however, that competition among alternative modes of transportation would prevent inequities to shippers that might arise from a unified rail service. Since a regional railroad would connect and interchange with a number of trunk line railroads outside the system at different points or gateways some guarantee of traditional gateway interchanges of traffic would be necessary.

The connecting trunk line railroads would compete with each other for traffic going and coming in the New England terminal area. Currently, some $600 million worth of freight originates in the New England area. This volume might give the unified New England system considerable leverage in bargaining with the interchanging railroads.[59] At the national level, it has been recommended that such a unified system should not only be operated as a single entity, but should be equally and jointly owned by the railroads with which it connects.[60] However, New England interest groups are likely to oppose "outside" control of a regional system as not promoting the best economic interests of the region.

However, a terminal railroad consolidation would lead to savings through the abandonment of circuitous and duplicating routes. For example, the Boston and Maine's more direct and efficient Hoosac tunnel route may be favored over the higher and slightly longer New York Central route west of Springfield. More efficient switching operations could result at many points that today are served by two or more railroads including Fitchburg, Lowell, Framingham, Worcester and Springfield. Centralized business promotion and centralized control of traffic would result in substantial savings if a regional consolidation could be effected.

Although such a terminal railroad may be more efficient than terminal operations now performed in Boston, the region would be permanently committed to the many disadvantages of a terminal operation. Opponents of the consolidated terminal plan suggest that few financial advantages would accrue from combining railroads which have little capital to spend on modernization.[61] These critics claim that many of the economies of consolidation could be achieved by closer cooperation among Boston railroads.[62] Furthermore, they suggest that such a merger would only combine roads with similar weaknesses. In addition, some early critics doubted whether such a merger would benefit New England ports. The New Haven would tend to use its more extensive facilities in the port of New York rather than its smaller facilities in the port of Boston, and the natural desire of railroads to obtain long-haul freight would favor New York.[63]

c. *Competitive Trunk Line Mergers*

Another proposed plan of consolidation for the Boston region is based upon the principle of maintaining competition. Each of the Boston railroads would combine with a stronger trunk line railroad serving the Midwest thereby resulting in combined systems offering through routes from the Boston region to the Midwest. Proponents of this alternative claim that the expensive terminal operations of the Boston railroads would be more than offset by profitable operations of strong trunk line railroads. They suggest that regional industries would gain from vigorous competition between the two systems and some duplication and waste would be eliminated.

Some smaller trunk lines outside New England that make important interchanges of traffic with New England railroads: the Delaware and Hudson with the Boston and Maine; the New York, Ontario and Western, Lehigh and Hudson, Lehigh and New England with the New Haven.[64] There have been various proposals to merge large trunk line systems and smaller interchanging railroads with New England railroads according to their traffic orientation.[65]

Some of the more important merger proposals merit further discussion. One proposal is to combine the Boston and Maine with the Delaware and Hudson and the Erie and Lackawanna to provide an improved unified rail system extending from New England seaports to the Middle West. Opponents of this proposal claim that the merger will result in a natural orientation to the Port of New York to the detriment of the Port of Boston, since the Erie and Lackakanna have important termini in the New York area.[66] Another proposal to combine the Boston and Maine with the New York Central would result in the shortest and lowest grade rail line from Chicago to Boston and the abandonment of the less efficient and duplicating Boston and Albany Division west of Springfield.[67] If any of the above

59. *Loc. cit.*
60. *Loc. cit.*

61. "A Railroad Policy for New England," *op. cit.*, p. 55.
62. *Loc. cit.*
63. *Loc. cit.*
64. *Ibid.*, p. 33.
65. *Ibid*, p. 50.
66. *Ibid*, p. 55.
67. Herbert E. Bixler, "Boston and the Railroad Merger Question." *Greater Boston Business*, August, 1961.

Boston and Maine trunk line mergers should occur, then the New Haven would also be forced to join a trunk line system. In this regard, the most frequently mentioned merger has been between the New Haven and Pennsylvania railroads.[68] In any case, if Boston and Maine-New York Central and New Haven-Pennsylvania mergers should occur, such points as Boston, Framingham, Lowell and Fitchburg would be served by two railroads that also serve the entire area east of the Mississippi and south of Virginia.[69]

d. *Current Developments*

At present, merger proposals would result in four principal Eastern railroad systems. Three of these systems would be "competitively balanced" and would be built around the following nuclei: (1) the Chesapeake and Ohio-Baltimore and Ohio; (2) the Norfolk and Western-Nickel Plate (which also might include the Erie and Lackawanna and the Delaware and Hudson); (3) the Pennsylvania-New York Central. The fourth system would include a group of New England rail carriers: the New Haven, Boston and Maine, Maine Central, Boston and Albany and Bangor and Aroostook.

The principal factor preventing implementation of any consolidation of Boston railroads with larger systems farther west, is the reluctance of any financially strong railroad to accept the weak New England railroads in a merger. Hearings have been initiated on a proposed merger of the New York Central with the Pennsylvania Railroad, neither of which are anxious to include the Boston railroads in the consolidation. If such a merger is approved, joining regional railroads to form the proposed consolidated through routes as outlined above would be impossible. The Boston railroads' strength would be improved considerably by a merger with the combined New York Central-Pennsylvania system, but it clearly seems to be in the region's interest that both the New Haven and the Boston and Maine be included if such a combination occurs. If only one of the two major Boston railroads were included, it would probably result in the demise of the excluded railroad. If a merger of Boston railroads with a larger system does not occur, then the Boston railroads face the prospect of continuing as weak regional railroads. In this event, a consolidated Boston or New England terminal railroad system would remain as an alternative.

At the national level, general plans of consolidation have been formulated on three different principles:

(1) Plans favoring the principle of competition between all major points within each region were developed by Professor Ripley under the impetus of the Transportation Act of 1920. The plan originally proposed 19 national consolidated systems with four to five trunk line systems in the Northeast. With the advent of the depression and increased competition from other modes of transportation, however, the plan was modified to include not more than seven national systems or two systems in each major region.

(2) Plans advocating a unified regional railroad with a minimum of competition within each region were favored by the National Transportation Committee in 1933 and were based on the Prince plan formulated in the same year. This plan proposed seven large regional systems, two in the east, two in the south and three in the west. Competition would be confined to a minimum number of through routes serving the most important traffic centers and competition would be eliminated at intermediate points within respective regions. The principal objection to this plan was that cities at the border lines of regional systems would be served by as many as four railroads while important traffic centers in the heart of various regions would be served by only one or two systems.

(3) A third plan, advocated by ICC Commissioner Miller in 1938, embodied the principle of a single railroad system serving the entire nation. It was claimed the savings would be greater and the problem of assigning various carriers to different systems could be avoided.

The entire question of merger is surrounded by controversy. The four-year protection of labor and the studies required to reorganize lines, terminals and communications systems in order to reap the benefits from consolidations are both expensive and time-consuming for railroad management and add to railroad risk and uncertainty in a changing economy.[70] Consolidation might afford economies on main through routes at the expense of points off the main line.[71] Other experts claim that some railroads have already reached large scale economies because of size.[72] However, the New York Central and the Pennsylvania are already the nation's largest railroads and still are among the low-earning railroads in the nation.[73] Although the low profits of large railroads might be due to high terminal costs in dense areas or excess capacity arising from diversion of traffic, economic literature on the savings inherent in large systems is inconclusive.[74]

Other obstacles to mergers have been evident over the last decade. One of the main obstacles has been lack of adequate incentive.[75] In most industries, merger is usually a result of economic expansion rather than decline. For at least 30 years railroads have not been a growing industry. In many cases they have found it difficult to secure the capital investment necessary to achieve the extensive economies and services advantages that consolidation may afford. In addition to the uncertainties that have already been discussed, there is the risk for stronger railroads who fear the consequences of absorbing hard-pressed neighbors.

68. "A Railroad Policy for New England," op. cit., p. 57.
69. Bixler, *op. cit*
70. *Notional Transportotion Policy, op. cit.* p. 261.
71. *Loc. cit.*
72. James C. Nelson, *Roilroad Tronsportation and Public Policy* (Washington, D. C., Brookings Institution, 1959), p. 183.
73. *Loc. cit.*
74. *Ibid*, p. 182.
75. *Notional Tronsportotion Policy, op. cit.*, p. 257.

CHAPTER SIX — PORTS AND AIRPORTS

PORTS

1. INTRODUCTION

Historically, ports of the Boston region have played a vital role in national growth and economic activity. The Port of Boston, with a total volume of over 20 million short tons of cargo annually, is the largest seaport in New England, both in extent of water-front facilities and volumes of water-borne trade. Within the six-state New England area, only Portland, Maine approaches Boston in tonnage. (See Figure 57).

Other regional ports are Salem, Gloucester and Beverly. Salem and Gloucester, famous for their contributions of men and ships during the post-revolutionary days and clipper ship era, still maintain certain specialized port activity, but along with Beverly, now play a limited, localized role. Shipping activities at Beverly are confined to imports of gasoline (162,000 tons). Trade at Salem has increased in the last ten years from 256,000 tons to 1.5 million tons, but nearly all of this tonnage consists of coastwise receipts of two commodities: coal (about 50% of the total), and gasoline and fuel oil (about 45%). At Gloucester there has been a modest increase in trade from 125,000 tons in 1950 to 185,000 tons in 1959, most of it concentrated in fresh fish and fish products. The function of these ports is primarily local — the great bulk of tonnage being destined for local markets.

Due to its substantially greater significance to regional development and its role in the trade industry than is the case with three other area ports, this chapter is primarily concerned with an analysis of the port of Boston and the Boston airport area.

A. *History of the Port of Boston*

Up to about 1750 Boston was the leading colonial port, and up to the time of the Revolutionary War, was primarily involved in trade between England and the West Indies.

Following the Revolutionary War, Boston's maritime economy faltered, mainly as a result of the exclusion of the United States from the British trading system. However, by the early nineteenth century, manufacturing enterprises in Boston's hinterland provided substantial volumes of manufactured products for shipment through the port of Boston.[1] The port also received shipments of raw materials for processing at local manufacturing centers from coastal and foreign ports.

In the middle of the nineteenth century, Boston was a major center for the clipper ship trade between the United States, Europe and other foreign ports. As the clipper ship era waned before the Civil War, so did Boston Harbor, partly as a result of increased competition from New York. New York's preeminent position in commercial port activity was due to the construction of the Erie Canal in 1825 and the subsequent development of direct rail connections along the Hudson and Mohawk valleys. New York's fine access to the west allowed it to capture new markets and this in turn stimulated additional port activity.

In the face of competition from New York, volume of trade activity at Boston's port grew substantially during the latter half of the nineteenth century, reflecting Boston's regional role in the expansion of New England industries and commerce. Growth of textile mills in Massachusetts helped Boston to become the second largest wool market in the world and made it a center of cotton imports. In the latter decades of the century grain and livestock cargoes became important to the Boston export trade.

Throughout most of the nineteenth century, coastal trade constituted a large part of the port's business. Up to the latter part of the century, when the railroads captured most of the freight and passenger business, almost daily passenger and freight service was provided to such northern New England cities as Newburyport and Portsmouth located at the head of navigation on the larger rivers. Ice was an important shipment from the north and contributed heavily to the total tonnage handled by Boston.

Boston's port activity weakened through the first decades of the twentieth century, as New York, Baltimore and Philadelphia absorbed an increasing proportion of the nation's domestic and foreign trade.[2] Boston declined markedly in foreign tonnage relative to these major competitors. By 1930 the port had fallen to last place in volume of trade among the four major North Atlantic seaports, where it has remained to the present.

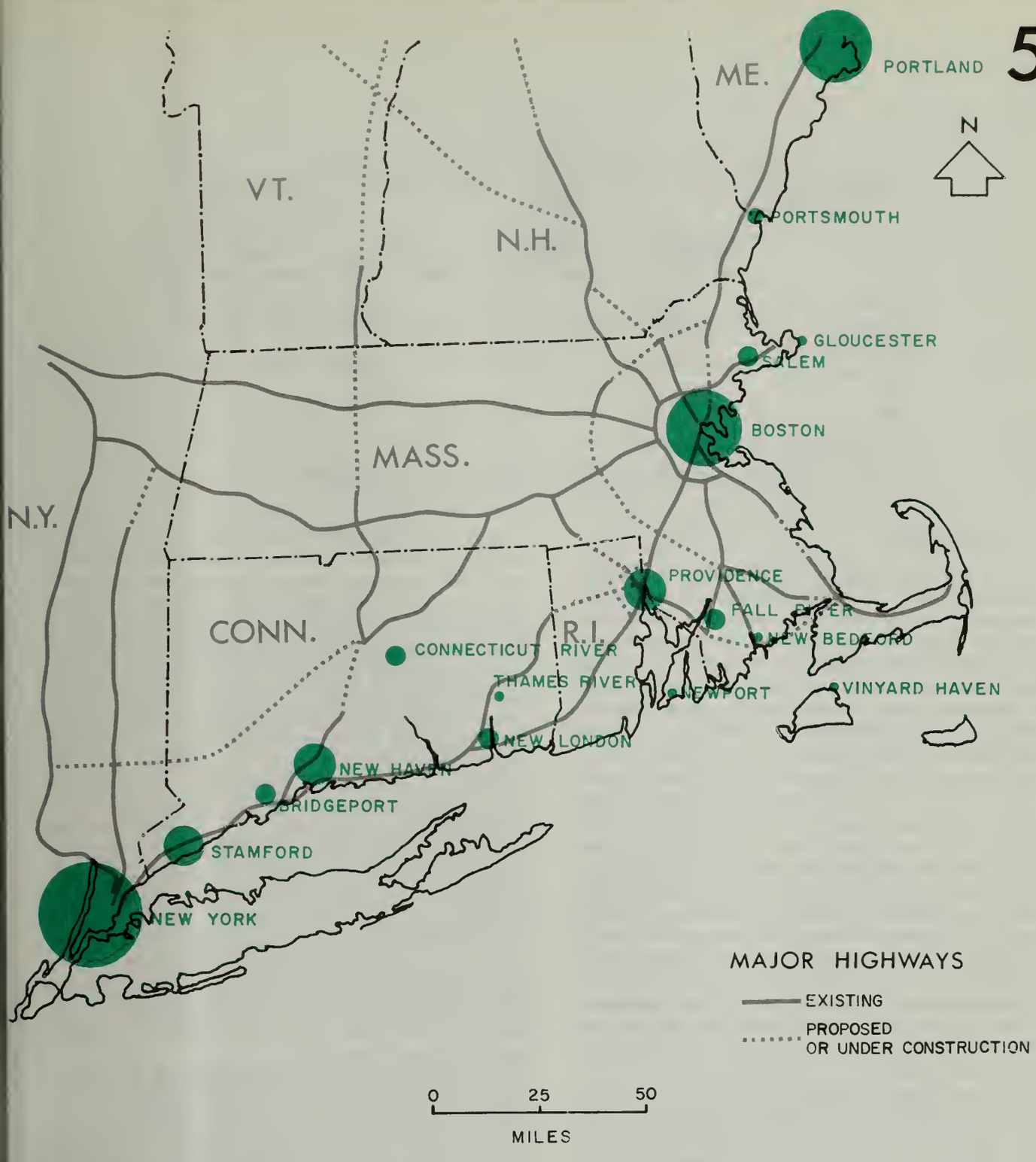
2. CHARACTERISTICS OF THE PORT OF BOSTON

Many factors are responsible for Boston's historic decline as a major port. Among them are the port's location away from the main stream of economic development, unfavorable rail and ocean freight rates, labor problems, and the difficulties which, in general, have beset the New England economy.

1. Writer's Program, Works Project Administration, *Boston Looks Seward; The Story of the Port,* 1630-1940 (Boston: Bruce Humphries, Inc.), p. 71.

2. The port of Norfolk, which is primarily a coal shipment center, has not been included in the Comparison of North Atlantic ports made in this chapter.


N
NORTHEAST
EXPRESSWAY
ROUTE 1A
MYSTIC RIVER BRIDGE
LOGAN AIRPORT
U.S. NAVAL YARD
POSTAL ANNEX
SUMNER & CALLAHAN TUNNELS
EAST BOSTON TERMINALS
COMMONWEALTH PIER
CENTRAL ARTERY
NORTHERN ARTERY
DRIVE
EXTENSION
TURNPIKE
EXPRESSWAY
HIGHWAY
EXISTING
PROPOSED OR
PRUDENTIAL CENTER



MAJOR HARBORS OF SOUTHERN NEW ENGLAND

TOTAL ANNUAL VOLUME OF SHIPPING, 1959
(IN THOUSANDS OF SHORT TONS)

UNDER 1000

1000 - 5000

5000 - 10,000

10,000 - 20,000

OVER 20,000

SOURCE: DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS, WATERBORNE COMMERCE OF THE U.S.

TABLE 72

MASSACHUSETTS PORT AUTHORITY — NET REVENUE, 1960 and 1961[1]
($000's)

	Mystic River Bridge		Airport Properties		Port Properties		Total	
	1960	1961	1960	1961	1960	1961	1960	1961
Total Revenues	$3,770	$3,915	$2,686	$3,242	$1,209	$1,059	$7,665	$8,216
Total Current Expenses	636	713	1,590	1,963	717	662	2,943	3,338
Net Revenue	$3,134	$3,202	$1,096	$1,279	$ 492	$ 397	$4,722	$4,878

1. Fiscal years ending June 30.

Source: Massachusetts Port Authority, *Annual Reports, 1960* and *1961.*

A. *Administration*

Public administration of Boston's port is a relatively recent innovation; until 1929 the port was owned and operated by private companies.[3] In late 1929 the Boston Port Authority was organized, to be financed by both the city of Boston and the Commonwealth. This dual management worked to inhibit the effective power of either group and a chronic insufficiency of funds for construction and modernization resulted in a gradual deterioration of port facilities.

In 1945 the Port Authority was reorganized entirely under the state government and was empowered to sell a $15 million bond issue for the improvement of port facilities. The new agency lacked the necessary autonomy in that its revenues were turned over to the state treasury and port expenses were met by an annual legislative appropriation. Throughout its existence its effectiveness was greatly hindered by frequent changes of key personnel and the Authority never succeeded in establishing a sound policy for the port's development, administration and promotion. In 1953 the legislature partially reorganized the port agency, but this reorganization did not sufficiently alter the cumbersome financial arrangement.

The most recent reorganization occurred in 1956 when the Massachusetts Port Authority was created.[4] This agency did not come into being until three years later (February, 1959) because of inability to sell its revenue bonds at the low rate of interest imposed by legislation.

The Port Authority differs from its predecessors in that it is organized as a self-supporting public authority financed by revenue bonds and with the right to use revenues for bond retirement and other purposes. In addition the scope of the Massachusetts Port Authority had been broadened. Unlike its predecessors, the Authority has additional transportation functions. Along with the operation of the Port of Boston, the Massachusetts Port Authority assumed responsibility for Logan International Airport, Bedford Airport and the Mystic River Bridge. The announced objective of combining these transportation facilities in a single agency was to secure benefits in administration and to develop integrated policies in operation, construction and development between complementary modes of transportation. Only an eighth of the Authority's revenue is currently derived from port operations. As indicated in Table 72, three to four times as much revenue is contributed by the Mystic River Bridge and airport properties.

The legislation establishing the Authority requires it to deposit revenues into a revenue fund and at the end of each month any balance is transferred in prescribed sequence and amounts to six separate funds: Operating, Port Properties, Interest and Sinking, Reserve Maintenance, Research, and Improvement. The Authority is required to make an annual payment to the Commonwealth for the port properties, if revenues allow. The main source of revenues for each of the operations are bridge tolls, airport rentals and concessions and port rentals.

In broad terms, the Authority's duty is to promote and protect the commerce of the city of Boston and of the metropolitan area. It performs these duties in two fields: 1) it develops, modernizes, and maintains its own facilities, and 2) it promotes trade, studies the problems of the port, and recommends harbor improvements and development of waterfront land for purposes not related to port operations.

The water-front area controlled by the Authority is a small but highly significant portion of the harbor. Out of the seven principal deep-water terminals in Boston harbor, six are under the jurisdiction of the Authority, and one is privately owned. Of the Authority's six terminal facilities, five have been leased to private firms. The rentals obtained from these leases constitute the major part of the Authority's revenue from port operations.

3. American Association of Port Authorities, *Ports of the Americas, History of Development* (American Association of Port Authorities, 1961).

4. Acts and Resolves 1956, Chapter 456

TABLE 73

PORT OF BOSTON — PRINCIPAL TERMINALS

Name of Facility	Location	Jurisdiction
Castle Island Terminal	South Boston	M. P. A.
Boston Army Base	South Boston	M. P. A.
Commonwealth Pier	South Boston	M. P. A.
Hoosac Terminal	Charlestown	M. P. A.
Mystic Terminal	Charlestown	M. P. A.
Wiggin Terminal	Charlestown	Wiggin Terminal Company
East Boston Terminal	East Boston	M. P. A.

The Port Authority has engaged in extensive capital improvements on its facilities; the value of construction in progress doubled from $8.4 million in 1960 to $17.0 million in 1961.[5] This increase is largely accounted for by extensive airport modernization activities.

B. *Geography*

Boston's port has expanded since 1800 to include approximately 47 square miles, much of it built on filled land. The harbor has several physical assets; including natural channels of sufficient width and depth to handle the largest commercial ocean-going vessels; no large rivers drain into the harbor and thus very little silting up of the channel bottom occurs to present dredging problems, and proper channel depths (30-40 feet) can be maintained without difficulty.

The distance between the harbor and the open sea is only about five or six miles from the pilot station into the harbor, a sailing time of about an hour. At New York this distance is 15 to 20 miles, or over an hour and a half in sailing time. At both Philadelphia and Baltimore the sailing time from the open sea into the harbor is even longer than at New York.

A geographic factor which was of considerable benefit is Boston's location 200 miles or more closer to European and Mediterranean points than other major Atlantic Coast ports.

Various topographic and geographic assets of the port favored Boston's growth in the nineteenth century when these advantages were coupled with an almost captive regional market. In the past one could distinguish an immediate hinterland supplied through Boston, and a larger hinterland shared by all North Atlantic seaports. However, Boston's immediate trading hinterland was always smaller than New York's; the extension of commerce into the interior was hindered by the fact that Boston's rivers are not navigable for any great distance as is the Hudson River System. Development of interior markets was also hampered by the topography of the state, particularly to the west by the Berkshire Hills. New York, on the other hand, was able to take advantage of the Hudson and Mohawk Valleys which provided an early route to the interior for water carriers and trains. The Erie Canal, opened in 1825, permitted New York to develop an early lead, never lost, in attracting waterborne commerce from the midwest.

Under present conditions Boston remains the dominant supplier for its own region but has not greatly expanded its influence in past decades. One reason is that competition from Baltimore, Philadelphia and other ports has increased. Their location, closer to the westward moving center of population and economic activity, as well as to centers of natural resources, have aided these ports in becoming major Atlantic coast centers. However, the situation is more complex than locational advantages and disadvantages imply, since modern modes of transporting goods have lessened the impact of natural barriers to the point where separate trade areas no longer exist.[6]

C. *Port Facilities*

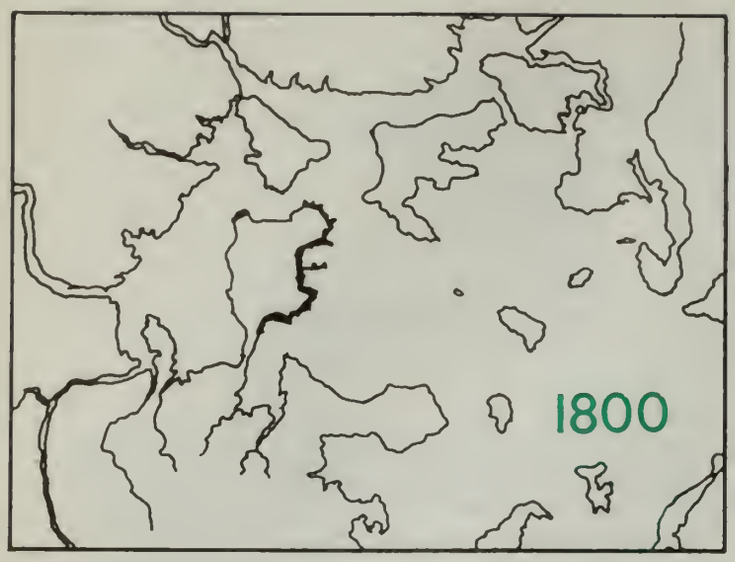
At present, the Port Authority is engaged in a $3 million rehabilitation program to improve piers and buildings and modernize cargo handling equipment. Each terminal consists of a series of wharves and piers, all of which are served by railroad lines. Within the terminals are various facilities for handling either bulk or general cargo. Bulk commodities usually consists of raw materials and scrap and are shipped in large tonnages. General cargo consists of manufactured items or products which have been processed and packaged. The port of Boston has facilities for handling both bulk and general cargo, although its general cargo tonnage is extremely limited. Major facilities at the port include the following:[7]

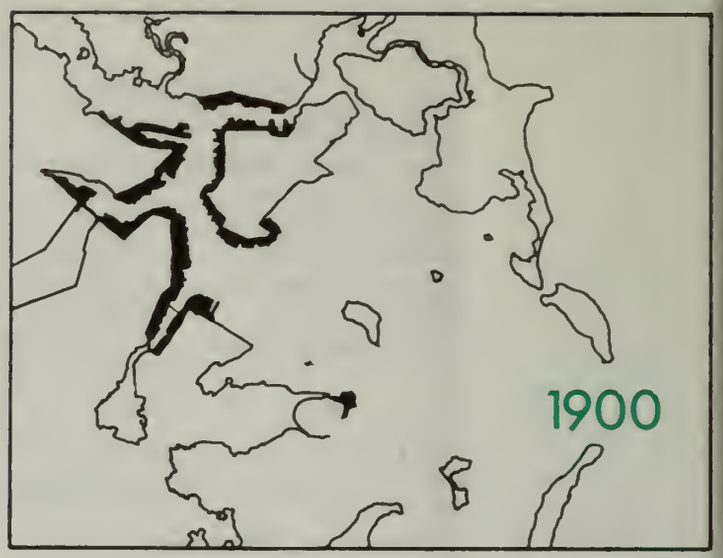
Facilities located at *Charlestown* include the *Hoosac Terminal,* containing 209,000 square feet of shed area with a storage capacity of 900,000 bushels of grain. There are several coal wharves and two general cargo terminals along the Mystic River. The U.S. Naval Yard has been at Charlestown since 1850. At the present time the yard's main activity is the repair, con-

5. Massachusetts Port Authority, *Annual Reports,* 1960 and 1961.

6. Jean Gottmann, *Megalopolis* (New York, The Twentieth Century Fund, 1961), p. 533.

7. Information concerning the port's facilities was drawn from: The American Association of Port Authorities, *Ports of the* Americas (1961) and U.S. Army Corps of Engineers, *The Port of Boston, Massachusetts* (Washington, D.C., U.S. Government Printing Office, 1957).













GROWTH OF BOSTON'S PORT AREAS

SOURCE: GREATER BOSTON DEVELOPMENT COMMITTEE, INC., SURGING CITIES, 1948.

version and fitting out of destroyers. A total of 9,000 civilians are employed, although the yard's permanent naval staff is only about 100. This large number of employees makes it one of the largest traffic generators in the downtown Boston area.

The *South Boston Naval Annex* contains one of the largest drydocks in the country and is an important naval repair station. The *Castle Island Terminal* located in South Boston contains 370,000 square feet of shed area and an 80-car capacity holding yard. Also located in South Boston are oil company facilities with a storage capacity of 1.6 million barrels of oil.

The *Commonwealth Pier* maintains a shed area of 690,000 square feet, slightly more than that maintained by the Boston Army Base. An entire pier is devoted to the activities of the fishing industry.

The *East Boston Terminal* contains four piers, a grain elevator and a warehouse, 546,000 square feet of shed area, 18,000 square feet of open pier and storage capacity of one million bushels of grain.

Also located in East Boston are ship repair and building facilities. Esso Standard Oil Company, located on the Main Ship Channel has facilities for storing 2.9 million barrels of oil. There are also oil tank facilities in Chelsea with a storage capacity of 5.8 million barrels of oil.

The Main Ship Channel piers on the southern waterfront of East Boston and in South Boston as well as the Reserved Channel specialize in general cargo. The Chelsea River area is predominantly used for oil shipments and the Mystic River waterfront in Charlestown and Chelsea concentrates on bulk goods. On the Charlestown side of the Mystic River this is combined with bulk goods manufacturing plants such as sugar and gypsum. On the western waterfront in East Boston are located most of the outfitting and ship repair piers.

In all, there were forty oil handling facilities throughout the port in 1956.[8] There is considerable public warehousing space for dry, cold and bonded storage, most of it located near the general cargo piers. In 1956 nearly 3.75 million square feet of storage space and 9 million cubic feet of cold storage were available. In addition, there are substantial areas available for open storage scattered through the port.[9]

D. *Ground Transportation Facilities*

a. *Railroads*

The port is served by all three railway companies of the region: the Boston and Maine Railroad, The New York Central System (Boston and Albany Division), and the New York, New Haven and Hartford Railroad.

The railroads serve the port on their own rail lines or through the switching railroad, the Union Freight Railroad Company. Rail yards are mainly concentrated in the Charlestown and South Boston sections of the harbor. The New Haven Railroad serves the south side of the Main Channel and both sides of the Reserved Channel. The company maintains several pierside and dockside spur lines. Facilities in Chelsea and East Boston, including spur lines along docks and piers give direct service to ocean going vessels. The Union Freight Railroad Company is the fourth line serving the port and has the function of linking two major railroad companies.

b. *Motor Trucks*

Trucks are playing an increasing role in the activities of all major seaports in the nation. Despite the availability of rail facilities there has been a continual shift to the use of trucks for cargo shipment, although trucks are primarily confined to the shipment of general cargo. Bulk goods such as iron scrap, cement and grain are more cheaply transported by rail. No established figures on general cargo movement at Boston are available, but it is estimated that trucks move 75% of all general cargo passing through the port, an increase in their proportionate share of approximately 15% over 1954.[10]

As the expressway system in the Boston area nears completion, improving truck access to the port, it is likely that truck movements will further increase their share of total cargo movements. Since as a rule, rates of motor carriers on shipments to the port, unlike rail rates, make no distinction between domestic shipments and foreign shipments, certain types of cargo shipments from Boston to many areas can be made more cheaply by truck.

The conversion to truck operations in the port has resulted in physical changes in the requirements of waterside facilities. The usefulness of many general cargo terminals now depends more on their adaptability to trucking operations than on their rail connections. Trucks require more maneuvering space than is often available along dockside areas developed with room only for rail sidings. Most truck terminals are not as conveniently located as are port rail freight yards, although some long distance carriers with substantial port business have established large truck terminals in the harbor area. The port area may be a logical location for an all-purpose trucking terminal, depending on the freight volume originating in the harbor and on the nature of the highway system serving the port area.

Sea-land operations, the transfer of truck containers onto ships, may affect the location of truck terminals. So far there is only a small volume of this type of handling, but in line with the steady growth of piggyback operations generally, it is expected that sea-land operations are likely to increase at the port.

8,9. Corps of Engineers, U.S. Army, *op. cit.*

10. Benjamin Chinitz, *Freight and the Metropolis* (Cambridge, Harvard University Press, 1960), p. 41.

TABLE 74

PER CENT DISTRIBUTION OF ALL CARGO HANDLED IN MAJOR ATLANTIC COAST PORTS, 1920 to 1960

	1920	1930	1940	1950	1960
New York	50.1%	57.0%	49.8%	47.7%	43.2%
Philadelphia	21.7	20.6	23.7	29.4	35.0
Baltimore	15.3	9.6	13.2	13.3	14.4
BOSTON	12.9	12.8	13.3	9.7	7.4
Total	100.0	100.0	100.0	100.0	100.0
Total Tonnage	72,071	115,069	131,344	181,994	235,004

Source: United States Army, Corps of Engineers, *Waterborne Commerce of the United States.*

3. TRADE TRENDS

Boston's loss of primacy in port activities, does not involve a decline in the tonnage of cargo passing through the port. Rather, Boston has lagged behind the three other major Atlantic Coast ports, New York, Philadelphia and Baltimore.

A. *Cargo*

Cargo tonnage figures for the 1950 to 1960 period illustrate this trend, as shown in Figure 59. Rates of increase in tonnage handled over the longer period, 1920 to 1960 are most impressive for the port of Philadelphia, which increased tonnage passing through its port by 425%. In this four decade period Baltimore increased by slightly over 200%, New York by about 180%, and Boston by only 87%.

Boston also ranked fourth among the four ports in the value of foreign trade. In 1960, New York imported cargo valued at $4,585 million, Philadelphia $718 million, Baltimore $618 million and Boston $450 million. However, while the total value of Boston's import cargo is below that of any one of the other three major ports, the average value per ton of cargo imported into Boston is more than double that in either Philadelphia or Baltimore. In 1960, the average value per ton imported through New York was $122, through Boston $81, in Philadelphia $16, and in Baltimore $31.

As a result of the slow rate of increase in tonnage handled at Boston's port, Boston's share of all cargo passing through the four-port group has declined. The decline has been gradual but consistent, as is indicated in Table 74. The same trend is evident in New York's port. On the other hand, Philadelphia increased its share of tonnage fairly steadily over the 1920 to 1960 period. Baltimore is the only port in the group which has remained constant in its proportion of cargo.

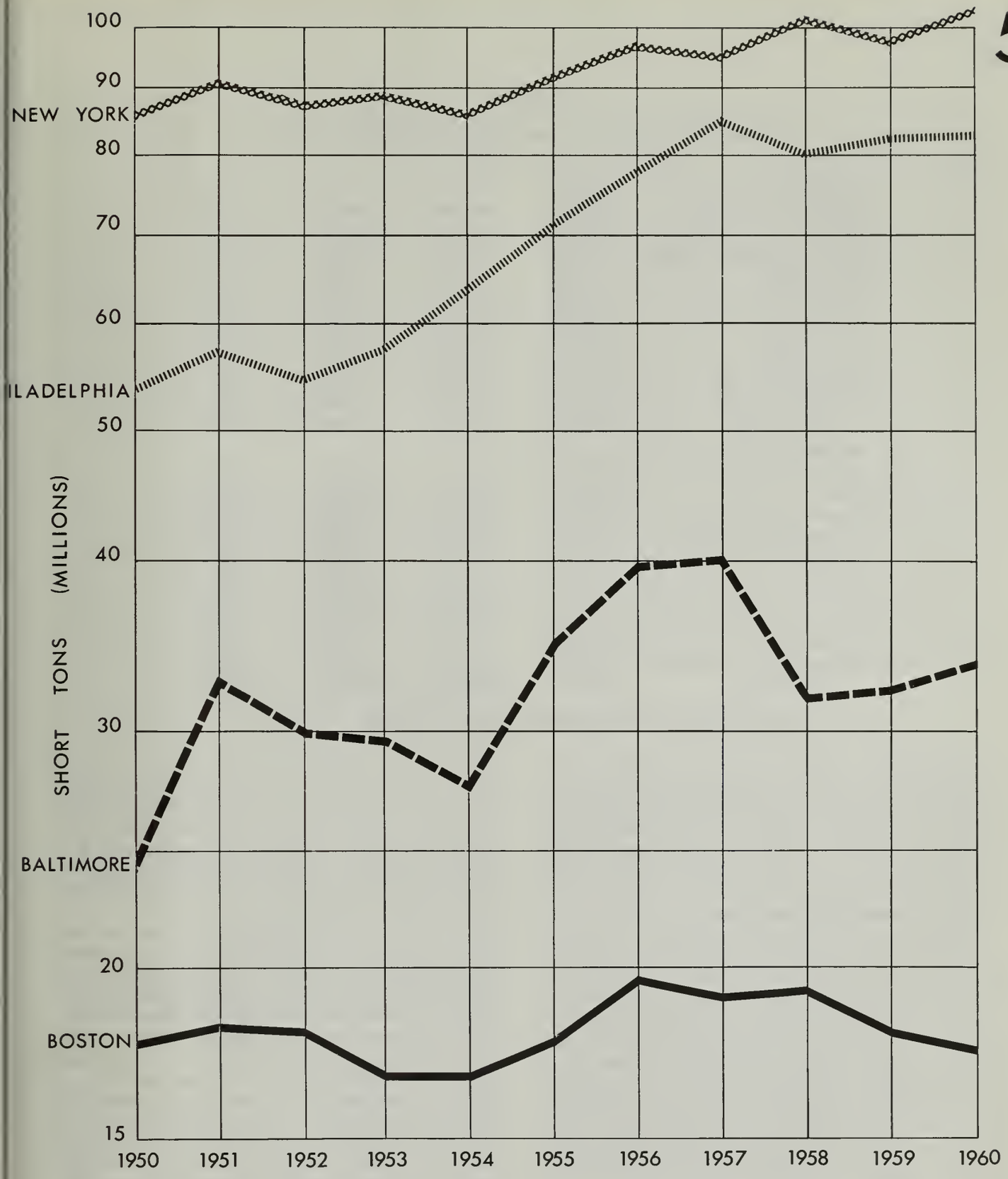
Total cargo passing through a port is one indication of relative importance but analysis of the flow of cargo in terms of imports and exports is more useful in gaug-

TABLE 75

STRUCTURE OF PORT ACTIVITY: PER CENT DISTRIBUTION OF FOREIGN AND DOMESTIC TONNAGE IN MAJOR ATLANTIC COAST PORTS IN 1920 and 1960

	FOREIGN		DOMESTIC		Total Short Tons
Port	Exports	Imports	Shipments	Receipts	(in thousands)
BOSTON					
1920	6.2%	18.1%	14.6%	61.1%	9,270
1960	5.4	31.9	3.6	59.1	17,341
New York					
1920	27.7	30.0	24.5	17.8	36,105
1960	7.5	36.9	13.5	42.1	101,626
Philadelphia					
1920	47.8	24.1	13.7	13.4	15,669
1960	3.3	53.0	9.2	34.5	82,310
Baltimore					
1920	61.3	29.0	4.8	4.9	11,027
1960	14.6	59.8	4.9	20.7	33,727

Source: *Statistical Abstract of the United States* and Corps of Engineers, *Annual Report, 1920*



PORT ACTIVITY IN SELECTED EASTERN PORTS
1950 – 1960

SOURCE: STATISTICAL ABSTRACTS OF THE UNITED STATES

TABLE 76

LEADING FOREIGN TRADE COMMODITIES, 1957-1960
(in short tons)

EXPORTS	1957	1958	1959	1960
Iron and Steel Scrap	316,245	202,480	275,077	500,260
Grain	882,539	332,833	337,271	275,657
Animal Products, Inedible	2,460	4,769	21,208	27,735
Paper Mfgs.	11,508	11,385	13,885	22,115
Chemicals	8,281	7,429	8,429	12,004
Machinery and Parts	6,656	8,430	8,813	10,671
Non Metalic	3,885	4,658	5,163	5,455
Wood Mfgs.	5,401	2,370	3,303	4,241
Rubber Scrap	6,349	3,363	3,005	3,962
Leather and Mfgs.	2,692	2,420	3,090	3,529
Total Exports	1,423,496	552,550	779,893	932,100
IMPORTS				
Petroleum Products	3,251,256	3,434,784	4,256,658	3,997,836
Sugar	446,318	447,132	458,625	434,612
Gypsum	190,835	192,006	214,347	206,695
Iron and Steel Products	46,457	69,991	50,838	119,311
Lumber	42,975	38,256	56,897	88,062
Woodpulp	91,187	77,186	104,147	79,204
Wool	—	52,832	76,636	53,668
Salt	27,562	21,404	40,004	40,801
Molasses	15,800	29,170	12,994	23,734
Rubber, Crude and Gum	46,687	45,239	46,781	28,500
Total Imports	4,933,014	4,968,620	5,982,687	5,532,500

Source: *Annual Reports* of the Massachusetts Port Authority.

ing the potential for future development and for understanding of a port's problems. An important trend occurring in all Atlantic Coast ports is the growing emphasis on imports and coastwise receipts over exports and coastwise shipments. In all four Atlantic Coast ports the volume of incoming cargo, both foreign and domestic far surpasses outgoing cargo.

In Boston a number of factors combine to work to the port's disadvantage. Boston is frequently a vessel's first port of call; cargo must be held in the departing ship for a longer period of time than if it were loaded at the last port of call. Also, service is limited. A survey dealing with "liner-type" vessels indicated that Boston was the only port of call for a vessel in four cases while New York held this position in 146 cases.[11] In spite of these disadvantages, Boston has increased its export volume since 1954. Boston has one advantage in its high frequency of first-call arrivals, since this makes it possible to deliver goods to the receiver at an earlier date than would be possible if they came from second or third port stops.

In most ports in the nation the leading commodity is shipped in bulk form. Petroleum, scrap iron ore and stone products are particularly important incoming bulk cargoes. All other freight, such as food and manufactured goods, is general cargo. The leading Boston imports are petroleum products, varying between 65% to 72% of the total. In New York, petroleum products take up to 72% of all imports, and 61% at Philadelphia. Imports at Baltimore are more related to the steel industry; petroleum products account for only 15% of incoming bulk tonnage while iron ore imports are about 60% of the total. Petroleum products also dominate the domestic trade picture at Boston. About 80% of coastwise receipts and 90% of coastwise shipments were petroleum products between 1956 and 1960.

The imbalance of trade at Boston is a fact of long standing and the result of an early twentieth century shift in the composition of exports, from agriculture to manufactured goods.[12] At the turn of the century Boston exported considerable amounts of agricultural products. Grain is still an important export. By the 1920's, however, agricultural exports had declined in most ports while nationally, manufactured exports had increased. Many of the problems at Boston's port arise from its inability to secure a reasonable share of outgoing manufacturing cargo.

11. Robinson, Romney, "Walter Transportation and New England", A report to the New England Governors Committee on Public Transportation, November, 1957.

12. Robinson, *op. cit.*

One reason for the relatively low volume of outgoing general cargo is that many local manufacturers do not use the port of Boston. Of 175 New England exporters who answered a questionnaire in 1949, only 7% made use of Boston's port.[13] A more recent study found that of 55 Massachusetts and Rhode Island exporting firms which did not use Boston, 40 were within 40 miles of the port.[14] The most frequent reason given for avoiding Boston was the greater frequency of sailings at other ports. Only 40 steamship lines serve Boston while 160 call at New York. The lack of adequate service and limited general cargo shipments is a self defeating pattern. Without substantial general cargo to export there is little chance of establishing a full itinerary of port destinations and without frequent sailings it is difficult to attract general cargo tonnage.

B. *Passenger Traffic*

Of the four major United States North Atlantic ports, Boston ranks second in the number of passengers. Table 77 compares the total passenger arrivals and departures between the U.S. and foreign countries at the four North Atlantic seaports. Boston's total of about 20,000 passengers annually is far above Philadelphia and Baltimore, but is only a tiny fraction of the nearly one million passengers handled by New York.

While other Atlantic ports have increased passenger volume between 1955 and 1961, Boston's passenger volume remained at 20,000 passengers. Growing competition from transatlantic air carriers makes it unlikely that ship passenger volumes out of Boston will rise to any great extent by 1975 unless some type of new European service is inaugurated.

13. Federal Reserve Bank of Boston, Monthly Review, "The Port of Boston" (Vol. 32, No. 2, February, 1950).
14. David J. Ashton, *New England Manufacturers' Export Practice and Potential* (Research Report No. 9, Federal Reserve Bank of Boston, 1960), p. ii.

TABLE 77

PASSENGER TRAVEL BY SEA BETWEEN THE UNITED STATES NORTH ATLANTIC PORTS AND FOREIGN COUNTRIES, 1955 and 1961[1]

	1955	1961
BOSTON	20,192	20,232
New York	889,463	955,549
Philadelphia	1,425	7,591
Baltimore	1,924	4,451
TOTAL —		
Four North Atlantic Ports	913,004	987,823
U.S. TOTAL	1,216,001	1,469,351

1. Year ending June 30.

Source: Immigration and Naturalization Service, *Annual Reports, 1955* and *1961.*

C. *Rate Differentials*

Major problems affecting the volume and direction of trade at Boston's port result from ocean and rail freight rate differentials. Since 1877 a fixed rail rate relationship has existed between the Midwest cities and the ports of New York, Boston, Philadelphia and Baltimore. Railroads serving Philadelphia and Baltimore were permitted under federal regulations to charge from 40 to 60 cents a ton less on foreign import and export shipments moving between North Atlantic ports and the Midwest.

Lower rates to the more southerly ports were first established by the railroads to offset higher ocean shipping charges on freight from these ports, which were 200 or more miles farther from Europe than Boston. This differential proved important in diverting the movement of bulk goods from Boston and New York but Boston did not have New York's lucrative general cargo tonnage to offset losses of outgoing bulk shipments. Even though ocean rates were equalized in 1935, differentials in rail rates continued. The ports of Boston and New York and the railroads serving the ports have for years been attempting to alter these discriminatory rates. In February, 1962, a U.S. District Court of Appeals ruled against the rail freight rate differential, but the ruling is subject to review by the United States Supreme Court and the question remains unresolved.

D. *The Back Haul Problem*

The railroad back haul problem is another major factor contributing to Boston's weakened position. Because the New England area is neither a significant exporter of bulk materials nor a major importer of general cargo from the Midwest, railroad cars coming from the west with materials for processing, and ships entering New England harbors with bulk cargo often return empty. The cost of returning empty carriers adds to the one-way cost of shipments to Boston and places the port at a disadvantage among areas providing return loads. This problem is compounded by the short line railroads serving Boston's port.

In addition to these competitive disadvantages, New York's strategic location together with long-established shipper habits and an impressive array of port services, has attracted a growing proportion of New England-originated port activity. As mentioned above, even in Boston's immediate hinterland a good deal of trade is channeled through the port of New York.

4. FUTURE OF THE PORT OF BOSTON

In the last decade, the port of Boston has not declined in cargo nor passenger traffic, but it has lagged in relation to other Atlantic ports. A number of factors will decide whether in the future Boston can regain a more important share of the North Atlantic trade.

In bulk cargo trade the continued importance of incoming petroleum products is virtually assured because of the great local and regional consumption of these products. However, it is possible that a shift in consumer heating habits, in favor of natural gas or other fuels or an extension of oil pipelines throughout the region could diminish incoming volumes of petroleum shipments. Court action may bring about the long-anticipated freight rate equalization. Much of the bulk cargo business affected by the rate differential has moved elsewhere but some of it can conceivably be recaptured.

Modernization of handling facilities, will do much to keep the port competitive in dockside service. Active promotion by the Port Authority may show positive results, similar to those achieved by Baltimore and Philadelphia.

With respect to grain exports, Boston's future is uncertain because of the St. Lawrence Seaway. However, the Seaway closes down for the winter, thus limiting its ability to capture Boston's grain trade.[15]

A number of specialized marine-oriented industrial services are located in the port area. Custom brokers and forwarders and offices of steamship lines and export firms are located adjacent to the waterfront and business district.[16] However, discontinued use of some harbor areas had led the Port Authority to promote industrial development of suitable sites. Sites considered suitable for industrial development include former piers, coal and lumber storage areas, an abandoned ferry site and an old motor terminal.

The waterfront is undergoing a gradual change with harbor facilities and water-oriented industries becoming more closely integrated. Two new cement distribution plants are expected to be established in the port area, one in the bulk cargo area on the Everett side of the Mystic River and the other at Castle Island, at a former coal distribution area.

Change in the harbor area may be further influenced by the Downtown Waterfront-Faneuil Hall Renewal Plan prepared for the Greater Boston Chamber of Commerce. This proposal covers about 100 acres along the Boston waterfront facing the Main Ship Channel from a point near the U.S. Coast Guard Station to Northern Avenue. The proposals for the area include high rise apartments, garden apartments, office buildings, restaurants, hotels and a large scale marina.

A further proposal affecting the harbor, which has been discussed for some time, is the filling in of the Fort Point Channel. The channel is not now an active part of the harbor, although it provides moorings for vessels and floating equipment. It is currently a receiving point for seafood and is occasionally used for shipment of refuse. With good highway access, filled land in this location might be suitable for intensive industrial and commercial use. Legislation has been introduced in the General Court to declare Fort Point Channel as non-navigable and to provide funds for the filling in of the channel.

15. J. R., Harley, *The Effects of the St. Lawrence Seaway on Grain Movements* (Indiana: 1957).
16. Harry E., Maul, *The Boston Produce Market and Environs* (Unpublished Master's Thesis, Massachusetts Institute of Technology, 1960).

5. SUMMARY

Recent reorganization of the port of Boston to bring much of its operation under the administration of the Massachusetts Port Authority has given the port a new identity. For the first time in many years, a scheduled plan of improvement has been undertaken to bring the facilities of the port on a par with other modern harbors. Despite severe economic handicaps, in recent years port activity in Boston has shown a stability in ocean-borne commerce. Continued improvements in harbor facilities may strengthen the port's attraction for ocean going vessels. Equally important as its role in freight transfer is its site potential for industries that require a large flow of water-borne materials.

Since all the trade coming through the port can now be handled at a few points with up-to-date equipment, some waterfront sites will become available for other uses. On the Boston waterfront a complete change to residential, commercial, and recreational uses has been strongly suggested. Elsewhere, new water-related industry is being encouraged and shows some signs of locating on sites with natural waterfront advantages as well as good rail and road access. The further development of the expressway system, particularly the Inner Belt, can be a major asset in attracting industry to the harbor area.

AIRPORTS

6. AIRPORTS IN THE BOSTON METROPOLITAN REGION

The location, distribution and function of airports has changed with the rapid growth of the aviation industry and the simultaneous progress in aircraft design. Airports, as the nucleus of the aviation system, require integration into a regional and national airport system to organize long-distance and local service.

A. *Boston-Logan Airport*

Logan Airport is the region's principal commercial facility. Serving three million passengers per year, Logan is the sixth largest airport on the east coast.[17] It opened for operation in September, 1923, and the first regular passenger service was inaugurated in April, 1929. From 1928 until 1941 the airport was leased by the state to the city of Boston for operation. The state

17. Measured in terms of total passengers per year, New York (two airports), Newark, Washington, and Miami have greater passenger volumes than Boston.

Department of Public Works assumed management in 1941 and operated the airport until 1948 when the newly created state Airport Management Board assumed control. Finally, in 1959, operation of Logan International Airport was transferred to the Massachusetts Port Authority.

Logan Airport is built over the mud flats of East Boston. It has an enviable location among major national airports because of its close proximity (three miles) to downtown Boston. Moreover, Logan enjoys easy access from every part of the region because it is close to the center of highway and public transportation systems.

Logan has another important asset at its present site; future expansion can take place without encroaching upon nearby residential and industrial areas. Lengthening existing runways or adding additional runways can be accomplished by filling in a part of Boston Harbor which is not vital to the operation of the marine port. On the basis of present traffic, and space estimates, there is sufficient open area close to the present terminals to accommodate anticipated future building requirements.

Logan Airport is currently engaged in expanding its terminal facilities on the basis of a development plan. The present passenger terminal has been reconstructed to provide four finger piers which permit 40 loading positions. Unlike the present decentralized arrangement under which each airline has its own waiting room and ticket office the new passenger terminals may include a more efficient centralized system of operation.[18] Other planned improvements include construction of more efficient facilities for corporation and private aircraft and expansion of parking to provide space for over 2,000 cars.

Operationally, Logan is one of the most modern airports in the country. Equipped with complete navigational aids, safety devices and a 10,000 foot runway, it is capable of handling the largest and fastest commercial airplanes currently in use. At present, Logan has four paved runways, one of which is equipped for ground controlled approach instrument landings. The current development plan provides for five paved runways, two of which will be usable for instrument landing. Logan Airport has been chosen as the site to test experimental landing systems under consideration by the FAA for installation at other airports.

B. *Lawrence Airport*

The only other airport in the region classified as a commercial air carrier facility is Lawrence Municipal Airport. The airport is located across the Merrimack River two and a half miles from the center of Lawrence and is completely within the town of Andover. At the present time this airport is not served by public transportation nor is it on a major expressway. Completion of the Outer Belt (Interstate 495) in the Merrimack Valley and other planned expressways will make the airport more accessible to a wide area in the northern and northwestern parts of the region and to southern New Hampshire.

The facilities at Lawrence Airport include a small but modern passenger terminal and a recently completed 5,000 foot runway capable of handling four-engine conventional aircraft. Recent improvements to the airport such as the new terminal and extended runway, have not been utilized fully because scheduled air service to New York via Northeast Airlines was terminated in mid-1962. Service at the airport is currently limited to a small number of connector flights to Logan.

C. *Boston-Bedford Airport*

Boston-Bedford was selected in 1940 to be the second state-owned airport in the Boston area, following a recommendation by the Massachusetts Aeronautics Commission that a traffic and weather alternate to Boston-Logan be established. Like Logan, it is operated by the Massachusetts Port Authority. Because of its location close to major industrial centers along Route 128, Bedford, which primarily handles nonscheduled air activity, has become the region's most important general aviation airport. In 1961, it handled over six times as many general aviation flights as Logan. (105,000 vs. 17,000). In addition to the business flights generated by nearby industries, the airport has attracted a large number of private aviation enthusiasts, particularly from neighboring high-income suburbs.

Landing facilities at Bedford include a 7,000 foot runway with 200 foot overruns and modern navigational aids. Complete ground services for transient as well as based aircraft are available.

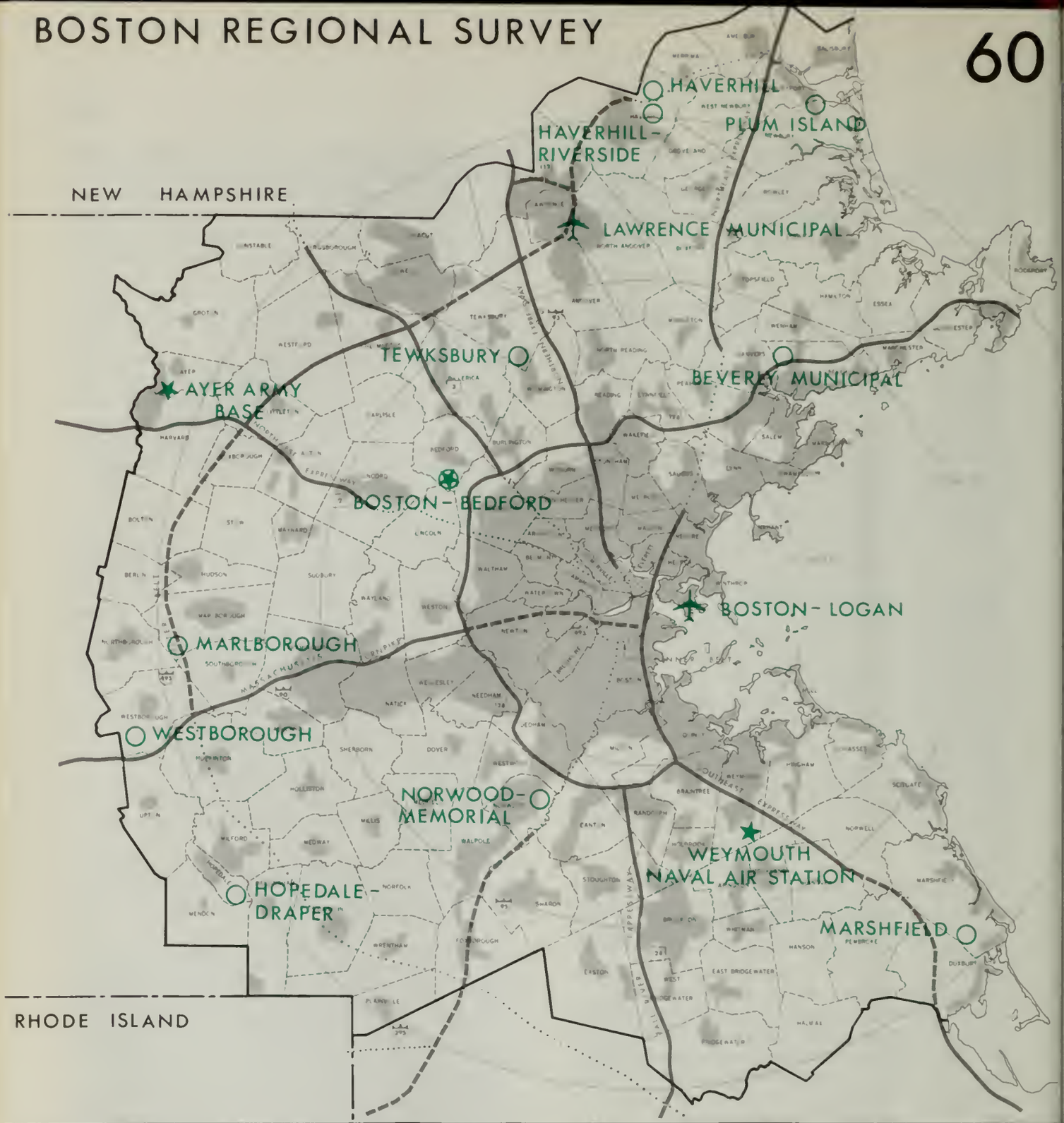
In addition to civilian activities, Bedford is a major U. S. Air Force Center for research and development in electronics. Approximately 10,000 persons were employed during 1959-1960 at the U.S. Air Force installations. Of these, about 1,000 were military personnel and the remainder were civilian employees working at the airport or in electronics firms adjacent to the airport.

The U.S. Air Force also maintains operational aircraft at Bedford, including single engine jets and cargo carriers. Military aircraft have a priority over civilian aircraft in flight operations and occasionally delay civilian flights.

Bedford appears to have sufficient room for future expansion at its present site. However, since the air approach to Bedford is not as strictly controlled as at Logan, increasing air traffic is likely to require more rigid controls of structural heights in approach zones. This may be achieved through the application of existing state legislation for community adoption of protective zoning for runway approach zones.

18. At the present time the International Terminal is under construction and the North Terminal is being designed. No action has been taken as yet on the South Terminal.

BOSTON REGIONAL SURVEY



EXISTING AIRPORTS, 1962

- AIR CARRIER AIRPORT
- GENERAL AVIATION AIRPORT OR LANDING FIELD
- MILITARY BASE

SOURCE: MASSACHUSETTS AERONAUTICS COMMISSION

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM 5 SHOWN ON MAP

NORTH

1 = 2560 ACRES SQUARE MILES

0 5 10 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THRO URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOU OF 1954 AS AMENDED

D. *Other Airports*

In addition to these three principal facilities there are 38 other airports in the Boston region. Two of these — the U.S. Army Fort at Ayer and the U.S. Naval Air Station at Weymouth — are limited to military flights and do not affect operation of the region's civilian airport system. Of the remainder, Norwood and Beverly are the most important.

Table 78 shows the number of based aircraft at public general aviation airports in the region. General aviation airports handle primarily non-scheduled flights. Both Norwood and Beverly have modern facilities. Beverly airport has 5,000 foot runways while Norwood has 4,000 foot runways. Each airport is served by operators providing gasoline, hangar and tie-down accommodations and facilities for major engine repairs and overhauls. The FAA has located its General Safety District Office at Norwood.

Norwood is close to the industrial concentrations along the southern arc of Route 128 and is served by a four-lane divided highway (Route 1). Beverly is somewhat less accessible to major industrial concentrations.

Other general aviation airports in the region include: Newburyport, Haverhill, Haverhill-Riverside, Tewksbury, Marlborough, Westborough, Hopedale, and Marshfield. In addition to the total of ten airports which are open to the general public, there are 23 landing fields restricted to private, non-commercial use which are of limited significance to the airport system (see Table 78). There are also three small seaplane bases on the Merrimack River, one in conjunction with Haverhill-Riverside Airport which are minimal, part-time operations.

TABLE 78

GENERAL AVIATION AIRPORTS: NUMBER OF BASED AIRCRAFT, 1961 and 1962

	1961	1962	Per Cent Change
Bedford	125	138	+ 10.4%
Norwood	81	88	+ 8.6
Tewksbury	40	40	—
Beverly	35	75[1]	+114.3
Newburyport	21	20	— 4.8
Marlborough	18	22	+ 22.2
Haverhill & Haverhill-Riverside	17	27	+ 58.8
Marshfield	14	17	+ 21.4
Westborough	12	10	— 16.7
Hopedale	10	12	+ 20.0
Lawrence	75	75	—
Logan	25	25	—

1. This large increase is accounted for by transfer of aircraft from Revere airport which suspended operations in 1961 because of expressway construction.

Source: Massachusetts Aeronautics Commission.

7. PASSENGERS, CARGO AND GENERAL AVIATION ACTIVITIES

A. *Passengers*

The airline transport industry has shown an impressive rate of growth in the last ten years. In long distance intercity transportation, airlines today carry almost as many passenger-miles in scheduled service as railroad and highway motor carriers combined.[19]

TABLE 79

TOTAL ONE-WAY PASSENGERS AT SELECTED AIR CARRIER AIRPORTS, 1950 and 1958

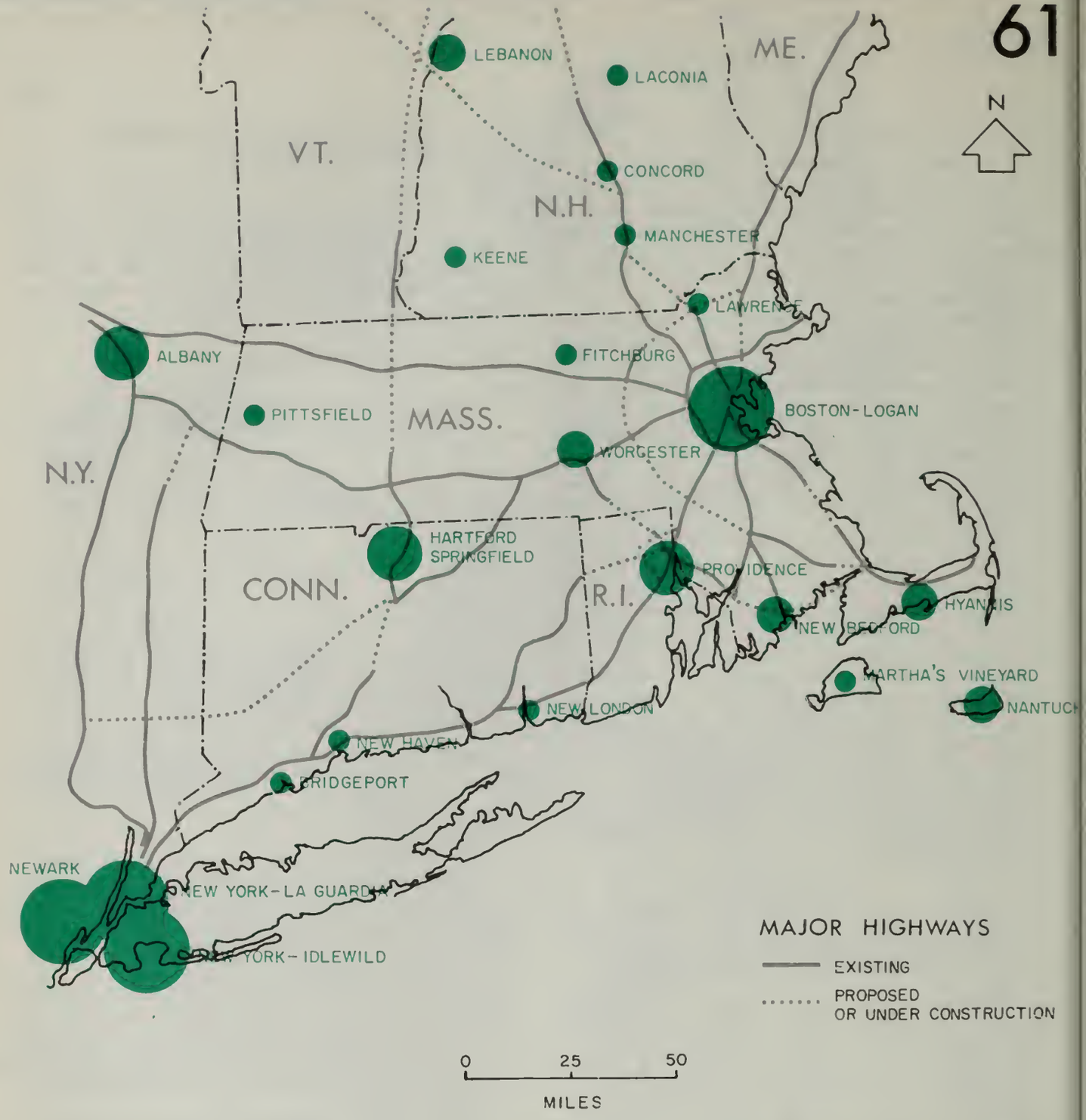
	1950	1958	Per Cent Change
New York (La Guardia and Idlewild)	1,801,888	4,502,100	+150%
Chicago (Midway and O'Hare)	1,438,069	4,090,146	+185
Washington	814,631	2,019,022	+148
Los Angeles	660,317	2,207,372	+235
Boston-Logan	455,818	1,178,913	+158
Newark	436,85	1,187,597	+172
Philadelphia	201,773	777,981	+285

Source: U.S. Department of Commerce, Civil Aeronautics Administration, *Enplaned Airline Traffic By Community,* 1951; and Federal Aviation Agency, 1959.

The number of commercial carrier aircraft departures doubled at Logan during the 1950-1960 decade, reaching 57,100 in 1960. At the same time, passenger volumes have almost tripled, partially reflecting the increased seating capacity of new jet aircraft. In 1960 approximately 1,500,000 passengers departed from Logan.[20] New York was the most frequent destination of passengers leaving Logan in 1959, accounting for 35.7% of the total; only 4.2% of passengers were bound for other New England airports. Passenger volumes at Logan and other southern New England airports are shown in Figure 61.

Boston is at the northern terminus of the most intensely used airline corridor in the country, connecting five major metropolitan areas: Boston, New York, Baltimore, Washington, and Philadelphia.[21] New York and Washington were the most frequent destinations of passengers departing from Boston. In August, 1962, there were 60 scheduled flights and 24 shuttle flights per day between Boston and New York. In addition there were 18 scheduled flights, eight of which included shuttle passengers, between Boston and Washington.

19. *National Airport Plan,* 1962-1966, Federal Aviation Agency, April, 1961, p. 3.
20. New England Council, *Master Plan for New England Airports.*
21. Gottmann, *op. cit.*



AIR CARRIER AIRPORTS OF SOUTHERN NEW ENGLAND

ANNUAL NUMBER OF PASSENGERS, 1960

- UNDER 20,000
- 20,000—100,000
- 100,000—500,000
- OVER 500,000

SOURCE: FEDERAL AVIATION AGENCY

TABLE 80

LOGAN AIRPORT: DOMESTIC AND INTERNATIONAL PASSENGER TRAFFIC, 1957-1961[1]

	1957-1958	1958-1959	1959-1960	1960-1961
Domestic	2,290,000	2,476,000	2,805,000	2,741,000
International	96,000	114,000	127,000	179,000
TOTAL	2,386,000	2,590,000	2,932,000	2,920,000

1. Fiscal year, July 1 to June 30.

Source: Massachusetts Port Authority, *Annual Reports, 1960 and 1961.*

Logan has expanded passenger volume at an impressive rate. (Table 79.) Equally spectacular has been the growth of international passenger volume which almost doubled in the four year period 1957-61, as shown in Table 80. Despite this increase, international passengers account for only 6.5% of Logan's total passenger traffic. Logan currently handles a total of over 3 million passengers annually. In 1960, passenger volume at the three New York Port Authority airports totaled 12 million while the volume at Washington reached 5 million.

The Federal Aviation Agency, in the proposals for the National Airport Plan, predicts that the 1950-1960 passenger growth rate will continue. The Boston region is expected to share fully in the nation's expansion of passenger traffic. The agency projects 43% increase in Logan's passenger volume between 1960 and 1966.[22] (Table 81 compares total passengers in 1960 with the 1966 forecasts for various airports.)

The Federal Aviation Agency found that the percentage share of passenger traffic of most areas in the United States has been relatively stable in the past twelve years and expects this stability to continue.

It is anticipated that for some time to come, the Boston region can continue to be served by one major airport. The National Airport plan suggests that only when traffic at an airport reaches 6 million passengers per year, should construction of a second field be considered. As indicated in Table 81, Logan is expected to serve 4 million passengers in 1966.

At Lawrence Municipal Airport, passenger volumes reached a peak in 1956-1957 with over 15,000 passengers. Since that date there has been a sharp decline, dropping to 11,317 in 1959 and 2,201 in 1960.[23] The decline between 1957 and 1959 was probably due to competition from Boston-Logan. Logan airport is within one hour's driving time of the market territory served by Lawrence airport. However, the drastic decline after 1959 was due to suspension of scheduled service to New York which had accounted for about 90% of passenger movement in Lawrence.

22. *National Airport Plan,* 1962-66, *op. cit.*

TABLE 81

TOTAL ANNUAL PASSENGERS AT SELECTED AIR CARRIER AIRPORTS, 1960 AND ESTIMATED FOR 1966

Airport	Passengers (000) 1960	1966	Per Cent Change
Boston-Logan	2,795	4,000	43.1
Lawrence Municipal	7	10	42.6
New York-La Guardia	4,660	6,700	43.8
New York-Internat'l	4,484	6,440	43.6
Newark	3,000	4,100	36.7
Washington-National	5,000	6,000	20.0
Washington-Dulles	—	3,500	
Philadelphia	1,854	2,662	43.6
Chicago-Midway	6,760	9,707	43.6
Chicago-O'Hare	2,765	3,971	43.6
Los Angeles-Internat'l	5,662	6,000	5.9
Los Angeles-New	—	3,000	

Source: *National Airport Plan, 1962-1966,* Federal Aviation Agency, April, 1961.

B. *Cargo*

Air cargo traffic increased by 70% in the 1950 to 1960 decade. This impressive rate of growth nevertheless did not compare with the increase in passenger traffic in the same period. However, in the three years between 1958 and 1961 cargo traffic registered an even more impressive 35% increase (see Table 82). Unlike the steady increase in passengers and air mail, cargo shipments appear to reflect trends in the business cycle.

Paralleling the increase in volume of international passengers, international cargo has increased at a rapid rate in recent years; a threefold increase in overseas cargo occurred during the 1958-1961 period. However, international cargo tonnage totaled only about 1.5% of domestic air cargo in 1961.

Air mail cargo has increased steadily since 1950 and as of 1961 totaled about 6,100 tons annually. Air mail represented about a sixth of all cargo in 1960 as compared to only a tenth in 1950.

While cargo increases at Lawrence Airport have shown impressive growth the total amount handled at this airport is quite small compared to Logan. In 1957,

23. *National Airport Plan,* 1962-1966, *op. cit.,* p. 13.

TABLE 82

RECENT TRENDS IN DOMESTIC AND INTERNATIONAL MAIL AND CARGO TRAFFIC, 1957 to 1961[1] (mail and cargo in pounds)

	1957-1958	1958-1959	1959-1960	1960-1961
Mail				
Domestic	7,701,104	8,250,359	9,280,694	12,006,196
International	144,936	162,500	152,634	163,647
TOTAL	7,846,090	8,412,859	9,433,378	12,169,843
Cargo				
Domestic	48,086,377	48,611,578	55,474,931	67,972,703
International	974,262	1,093,730	1,961,070	3,047,711
TOTAL	49,060,639	49,705,308	57,536,001	71,020,414

1. Fiseal years, July 1 to June 30.

Source: Massachusetts Port Authority, *Annual Reports, 1960* and *1961*.

Lawrence handled 120 tons of freight and 38.5 tons of air mail. Freight tonnage at Lawrence represented less than 1% of Logan's total freight cargo. At this smaller airport, air mail cargo represented nearly one third of freight cargo, a much higher percentage than at Logan.

Large jet planes are expected to stimulate considerable nationwide growth in volume of air freight.[24] Because of the suitability of many of this region's products for air freight (such as electronic products of small size and weight but high value), Boston-Logan will probably continue to increase its air freight business. Logan's large number of scheduled domestic flights and the fact that it is the first stop on many international flights will also help to increase its air freight volume. Air cargo facilities have been expanded at Logan by construction of a new cargo terminal, and further expansion is planned.

Boston-Bedford is also expected to handle more freight in future years. Present facilities at Boston-Bedford are capable of handling scheduled cargo flights — there are none at present — if such flights are warranted by increased freight volume.

C. *General Aviation*

During 1957, the nation's 66,000 general aviation aircraft flew a total of 10.9 million hours. In contrast, during the same year scheduled airlines with approximately 1,500 domestic aircraft flew 3.7 million hours.[25] By 1960 the general aviation fleet had increased to about 75,000 aircraft, a gain of 14% over 1950; this compares to about 1600 aircraft for scheduled domestic airlines which represents a gain of only 6%. However, with the changeover to large jets, seating capacity of commercial planes has increased more than the percentage gain in aircraft.

General aviation has developed three types of uses, each with specific requirements in aircraft, airport location and facilities.. These are (1) specialized commercial flights complementary to existing scheduled flights, (2) business flights, and (3) recreational flights, including instruction.

Specialized commercial flights, termed third level air service (air taxis, feeder flights), have grown in recent years throughout the nation. In some areas there appear to be growing opportunities for air service over short distances in small aircraft. In the Boston region, this type of feeder service may be of value in servicing both Boston-Logan and Lawrence airports.

Seasonal third level air service seems to hold considerable promise. Recreational travel in New England causes a sharp increase in the demand for this service during summer months. Northern New England resorts as well as Cape Cod, Nantucket and Martha's Vineyard are frequent destinations of feeder flights.

Business or corporation flying ranges from the use of single engine craft by traveling salesmen or distribution services, to the jet-powered twin-engine, 20 passenger luxury aircrafts flown by major corporations to shuttle executives around the country. Some of these companies maintain a fleet of aircraft and actually operate on a semi-scheduled basis to provide service compatible with the firm's air travel requirements.

The individual salesman or distributor type of operation has not developed rapidly in this region because of the relatively small distances and well-developed expressway connections between major population centers. Corporation flights generally use airports which combine adequate ground facilities and good access. Logan, Bedford, Lawrence, Beverly and Norwood handle most all such flights.

Bedford airport, the region's most important general aviation facility, served 105,000 civilian plane movements in 1960. This was equal to the number of domestic carrier movements at Logan during this same period. In addition to this large number of civilian flights Bedford handled an almost equal amount of military flights in 1960.

Increases in general flying will not be entirely restricted to general aviation airports. Along with Law-

24. Gottmann, *op. cit.*, p. 542.
25. *National Airport Plan*, 1965, Federal Aviation Agency, April 1959, p. 3.

rence airports, Boston-Logan is expected to accommodate additional general flying activities, particularly for business use, because of its location close to downtown Boston. When the volume of general flying begins to interfere with the movements of air carrier aircraft, it is anticipated that a separate landing strip for general flying will be provided at Logan. Boston-Logan airport experienced an increase of 44% in general aviation flights between 1953 and 1959.

At other general aviation airports, neither complete data on passenger count nor the number of flights made are available. However, the number of based aircraft shown in Table 78 gives some indication of their relative importance.

Recreational flying requirements are much less complex than those of other segments of general aviation. Since it generally comprises small aircraft traveling short distances under visual flight rules and good weather conditions, runway length requirements are generally lower than those required for business flights, and ground facility requirements are minimal. Moreover, recreational flying usually reaches a peak on weekends during the summer when business flights are few.

A 72% growth in licensed aircraft occurred in Massachusetts between 1951 and 1961, an increase from 950 to 1639 aircraft. A continuation of rapid expansion in general aviation flying is anticipated for the next decade and the Boston area will probably share fully in this growth. The use of general aviation flights for movement of low bulk, high value electronics and related cargo will probably continue to increase.

8. AIRPORT PLANS

Three airport plans have been developed which have a major bearing on the Boston Metropolitan Region:

(1) *Airport Program for Massachusetts Bay and Environs,* prepared by the Massachusetts State Planning Board, April, 1946.

(2) *National Airport Plan, 1962-1966,* prepared by the Federal Aviation Agency, April, 1961.

(3) *A Master Plan for Regional Airports to Serve Scheduled Air Transportation Needs of New England,* prepared by the New England Council, June, 1961.

A. *The 1946 Airport Program*

The area covered by the 1946 Airport Program included 100 cities and towns in the region. There were 13 airports within the area at the time, including 2 military airports. The program was based on the projected need for specialized airports to handle commercial scheduled, commercial non-scheduled and private flights. The plan proposed 2 scheduled airports, 3 non-scheduled airports, 3 mixed airports (for scheduled and non-scheduled flights), 27 private airports, in addition to 2 existing military air installations. Twenty-four new airports were recommended for construction, most of them located close to high income residential areas. The proposed addition of 24 airports was clearly optimistic. Since 1946, 8 airports have been closed and 5 new airports were established in the region with the results that there are 3 fewer airports in 1962 than in 1946.

Airports, because they are large, open, flat areas, often surrounded by residential neighborhoods, are frequently the target of land developers. Retaining general aviation airports within the built-up areas of the region may require municipal ownership. In some instances inter-community airports may be feasible. Although no use has been made of it in the region, legal authority exists under state law for two or more municipalities to form a joint airport commission for the purpose of establishing and operating an airport as a joint venture. Such a commission is given the right to acquire property for airport purposes by eminent domain. Under the agreement a joint airport is eligible for federal and state contributions.

B. *The National Airport Plan, 1962-1966*

This report, prepared by the Federal Aviation Agency, based its proposals on criteria developed from economic and operations research, taking into consideration local circumstances such as availability of suitable land and expansion possibilities. Figure 62 shows the location of the 15 airports recommended for the region. The plan retains Boston-Logan and Lawrence Municipal Airports as air carrier airports. Although the region's air carrier airports accommodate general aviation, it was assumed that there is need for airports in outlying areas because of increased general aviation activity. The National Airport plan suggests that in metropolitan areas a community with 10 aircraft owners may be justified in creating a small local airport if no field exists within 10 miles or 30 minutes driving time.

Of the 13 proposed general aviation airports, 4 are now in operation at Bedford, Beverly, Newburyport and Norwood. The plan proposes 9 new airports as follows: two near Route 128 (Gloucester and Wellesley); 2 within the Route 128 perimeter and close to major north-south arteries (Revere and Quincy); and the remaining 5 distributed throughout the region (Lowell, Framingham, Brockton, Groton and Pembroke).

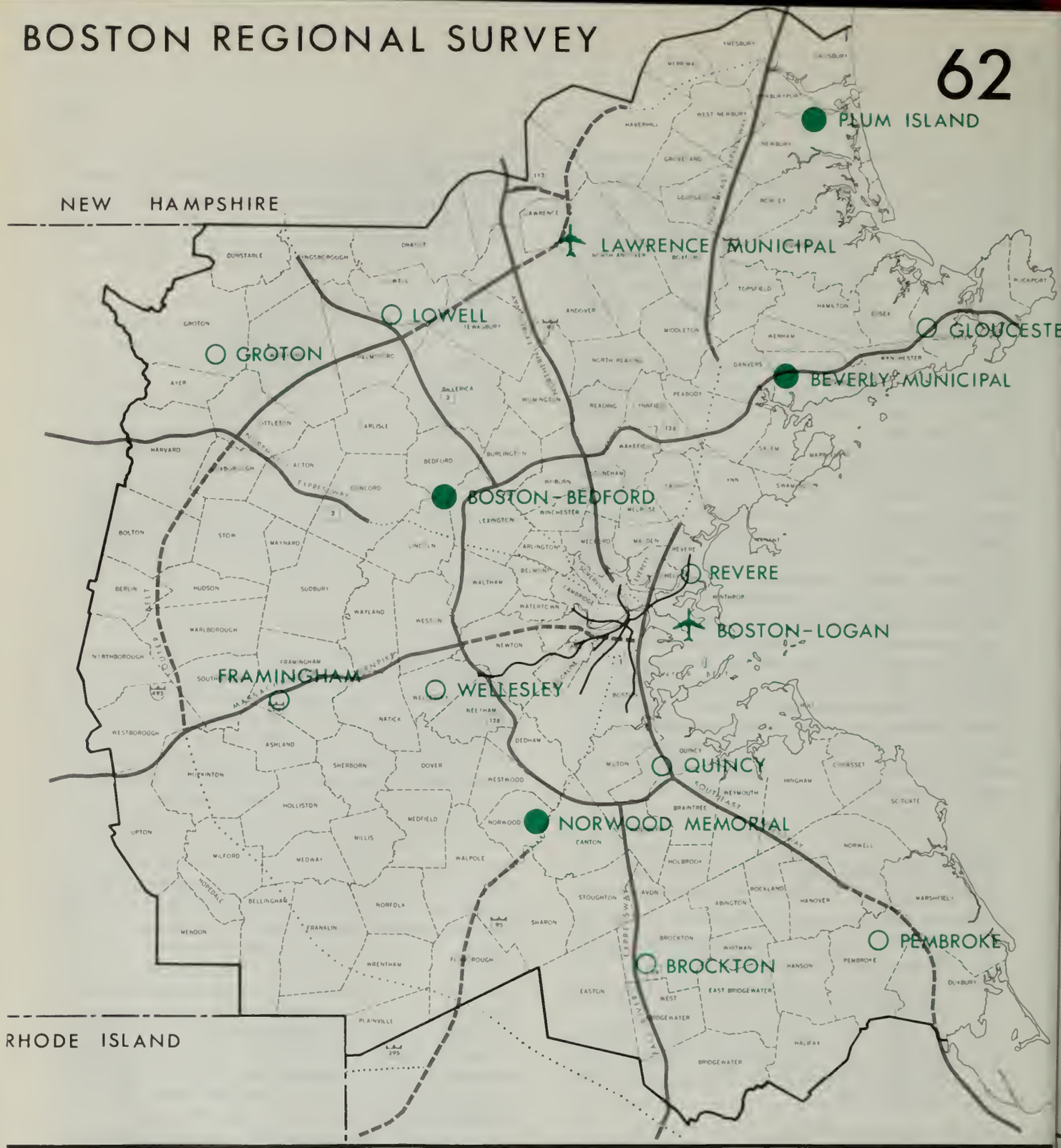
Seven existing general aviation airports are not included because the plan suggested that their distribution and facilities do not serve the region as well as these in the proposed plan. These are Haverhill, Haverhill-Riverside, Tewksbury, Marlborough, Westborough, Hopedale and Marshfield.

C. *Master Plan for Regional Airports*

The New England Council's Master Plan for Regional Airports, prepared in 1961, recommends location of regional airports to accommodate scheduled air com-

BOSTON REGIONAL SURVEY

62



NATIONAL AIRPORT PLAN, 1962-1966

- AIR CARRIER AIRPORT
- GENERAL AVIATION AIRPORT EXISTING
- GENERAL AVIATION AIRPORT PROPOSED

SOURCE: FEDERAL AVIATION AGENCY, APRIL, 1961

GENERAL INFORMATION

- EXPRESSWAYS
 - UNDER CONSTRUCTION
 - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 SQUARE MILES = 2560 ACRES

0 5 10 MILES

PREPARED FOR THE MASS TRANSPORTATION COMMISSION BY THE PLANNING SERVICES GROUP, CONSULTANTS

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED



NEW ENGLAND COUNCIL

MASTER PLAN FOR REGIONAL AIRPORTS

SOURCE: NEW ENGLAND COUNCIL

merce through 1970. The plan is based on two general criteria: ground access time and maximum utilization of existing facilities.

Minimum airport design standards were established including: (1) runway length of not less than 5,000 feet, (2) all-weather instrument landing systems, and (3) maximum ground travel time for the service area not to exceed 60 minutes.

The plan recommended a major reduction in the number of airports, concluding that New England should be served through 20 regional airports for scheduled air commerce instead of through the 32 airports presently used.[26] Location of the 20 recommended airports is shown in Figure 63.

This plan has been presented to the Civil Aeronautics Board, the Federal Aviation Agency, and the airlines providing service in New England. If adopted, it may result in the establishment of a regional feeder system tying Boston more closely to the rest of New England. The New England Council has already asked the CAB to investigate the possibilities of an expanded air taxi or air feeder service to connect the proposed regional airports with the many other airports in New England.

Public hearings on the future of the region's airports were held by the CAB in Washington, in November, 1962.

9. EMERGING PATTERNS OF AIR TRANSPORTATION

Metropolitan growth and expressway construction are major factors affecting the pattern of air transportation. Many cities are too close to permit effective intercity air carrier service, particularly because new aircraft development has concentrated on larger and faster planes which make operation over short distances uneconomical. In some areas, especially along the nation's east coast, the great amount of time required to reach airport terminals has made travel by automobile between major cities competitive with air service on a time as well as a cost basis.

In recent years there has been a growing tendency for the largest city in any group of cities to act as a traffic-receiving point for the entire cluster. This central airport influence has been termed a "traffic shadow." The construction of expressway systems connecting closely spaced metropolitan areas has caused traffic shadows to increase in size.

Since World War II air carriers have developed diversified services catering to specialized passenger needs. Because passenger aircraft design has concentrated on large aircraft which cannot efficiently serve local, small passenger volume airports, a so-called third level of service below trunk and local services has developed.

26. The 12 existing airports not included as regional airports in the master plan are: New Haven, Conn ; Laconia, Concord and Berlin, N. H.; Lewiston, Rockland, Waterville, Houlton and Bar Harbor, Maine; Pittsfield and Fitchburg, Mass.; and Rutland, Vermont.

Trunk line service connects major population centers. Routes between Boston and New York, Chicago and Washington are examples of trunk lines. Local routes serve small population centers that can support regularly scheduled airline service using medium-sized airplanes. A typical example is the route between Boston, Hartford, Albany, Syracuse and Buffalo. Feeder services, or third level service connect local and trunk line airports with each other, and with smaller population centers. This type of service is usually provided by small, economical-to-operate airplanes generally seating less than a dozen passengers. A typical service may shuttle between two points, such as Nantucket and Boston, or may serve several cities. An experimental scheduled service was established by a small airline company in June, 1962, to operate for one month between Boston and several points in New Hampshire. It is probable that some feeder routes may not be able to operate without subsidies.

The air traffic industry has been through a phase in short and medium-distance routes which has a parallel in railroad and electric streetcar history. Competition led to over-extension of services and the current trend is to reduce total route mileage by eliminating unprofitable routes. Reductions in service have in turn caused further reduction in patronage. For example, Northeast Airlines has cut back some if its service to smaller communities in its service area and is hoping to make further reductions, a program which has already affected Lawrence Airport.

The future of commercial airports located near Logan Airport does not appear promising. Lawrence Airport is about 45 minutes driving time from Logan, and has found it difficult to continue its activities as an air carrier airport because of this proximity.

A. *Ground Transportation*

A continuing problem of air transportation is the movement of passengers to and from the airport. However this does not present a major problem in Boston, because Logan is located close to downtown Boston, the hub of the region's highway and public transportation systems.

Among major airports only Washington, D. C. has its airport as close to downtown as Boston. Most other major airports in the country are in suburban locations with traveling times to downtown by taxi or coach of about one hour or more. Table 83 shows ground transportation distances and times from airport to downtown of some of the nation's major airports. Private cars and taxis carry about 90% of Logan's passengers. There is no airport bus service to downtown as at many other major airports, but a nearby MTA station is connected to the terminal by a shuttle bus service. Although the airport subway station is a short bus ride from the terminal buildings, passengers make little use of public transportation. Most of the estimated 10% of persons

TABLE 83

GROUND TRANSPORTATION, DISTANCE AND TRAVEL TIME FROM AIRPORT TO DOWNTOWN AT SELECTED AIR CARRIER AIRPORTS

	Miles	Minutes	Conveyance
BOSTON	3	20	Automobile
Washington	4	30	Automobile
Philadelphia	7½	35	Automobile
Miami	7	45	Automobile
Newark[1]	12	50	Automobile
Detroit	20	50	Automobile
N. Y. Idlewild	16½	60	Automobile
	17	30	Helicopter
N. Y. La Guardia	9½	60	Automobile
	8	20	Helicopter
Los Angeles	14	60	Automobile
San Francisco	13	60	Automobile
	10	15	Helicopter
Chicago, Midway	15	60	Automobile
Miami Beach	14	75	Automobile
Chicago, O'Hare	23	80	Automobile
	20	30	Helicopter

1. Time and distance to New York City.

Source: Airline Schedules.

who reach the airport by subway are probably airport and airline employees.

Helicopters appear to have a potentially useful role in intermediate and longer distance dispersal of passengers elsewhere in the country. At present, however, the cost of helicopter service does not justify a scheduled service in the Boston region, partly because of good highway and transit access to Logan. A recent attempt to connect Logan with Bedford and other points along 128 by helicopter failed shortly after initiating the service.

It is possible that in the future helicopters can supply a specialized service to suburban industrial and commercial sites. Such service may develop in conjunction with more economical lease and charter arrangements with individual firms rather than as scheduled services.

Apart from the competition between different air services, a new challenge to air passenger traffic has emerged over the last few years. In the heavily urbanized areas, such as the urban regions between Washington and Boston, highway construction has provided excellent intercity connections. Over medium distances up to about 250 miles the automobile can frequently provide competitive travel times between major city centers mainly because of long travel times required to reach air terminals. A substantial reduction in rail times between east coast cities which could be achieved through use of high speed trains or monorails might also have a significant impact on air travel volumes.

10. SUMMARY

Boston-Logan is and will remain for the foreseeable future the only important air carrier airport in the region. Growth in passenger and cargo traffic at Logan has kept pace with other major airports of the country, and its present and proposed operational facilities appear to be adequate to handle safely the growing number of passengers and amount of cargo on both domestic and foreign flights. It is also able to accommodate anticipated general aviation needs, which include the rapidly expanding segment of business and executive flying.

Lawrence Municipal Airport, the only other air carrier airport in the Boston region, has had difficulty in maintaining a volume of traffic which warrants scheduled local air service. The experience of Lawrence and other small airports indicates that the trend toward larger planes, the increasingly competitive nature of the airline business, improved ground access to major airports from fringe areas and faster automobile travel times over intermediate distances have created new conditions requiring a new air traffic plan.

The New England Council's *Master Plan for Regional Airports* has attempted to meet these new circumstances by recommending a reduction in the number of air carrier airports in New England, and as part of the same policy, recommends increased development of third level carrier, or feeder services. This policy requires low capacity planes on feeder routes to serve the major airports.

Of the several general aviation airports for business and private flying, Bedford is by far the most important, and will remain so in the future. Unless there is a major increase in military activity, facilities at Bedford appear adequate for future needs. Other general aviation airports are distributed throughout the region and also appear adequate for present and future needs. The Federal Aviation Agency's Airport Plan, 1962-1966, recommends few changes, except within or near the area encircled by Route 128. In this part of the region, the construction and reconstruction of two general aviation airports is recommended. Airports in such areas of intense urban development may have to be safeguarded from urban development by municipal ownership.

The next decade should see growing competition between road travel and air travel over short to medium distances. With improving highway connections between major business centers and increased ground access to airports, the automobile appears to have an advantage up to distances of about 250 miles. This competition will have a significant impact on the passenger volumes of scheduled flights and on general commercial and executive flights.

Conclusion

The Boston Regional Survey was significant for two reasons. First, it presents an analysis of major planning developments and issues in the Boston region, a task which heretofore had never been effectively accomplished.

Equally important, the survey laid the foundation for the nation's largest program of transportation planning and mass transportation demonstration experiments.

The survey indicated that the obstacles to effective, realistic action are formidable but the environment for implementation is improving.

The Boston trail-blazing Planning and Demonstration program must clear a path through a vast underbrush of inertia and thread its way through a fractionated governmental structure.

With the publication of this report and the initiation of the Planning and Demonstration program a major first step has been taken, but the term of trial has just begun.

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